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Canadian Mining Review

Established 1882

Vol. XI.—No. 1. 1892—OTTAWA, JANUARY—1892. Vol. XI.—No. 1.

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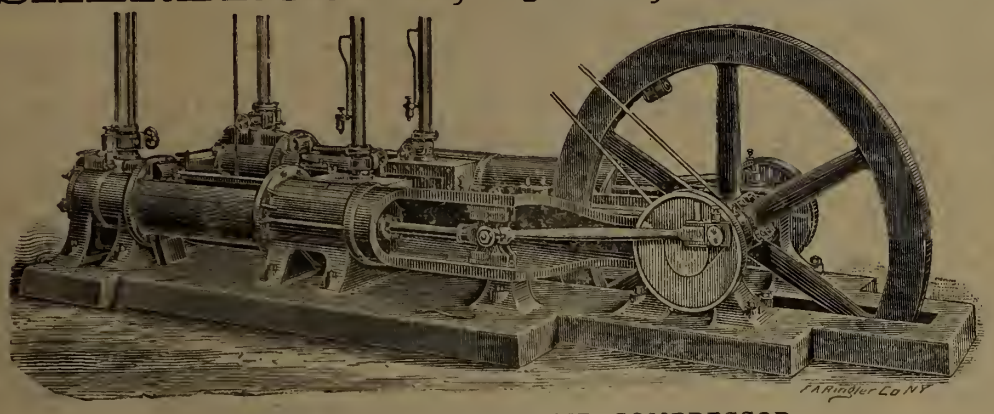

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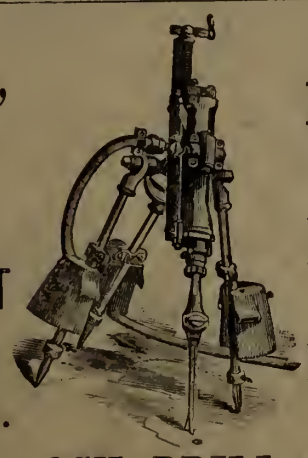

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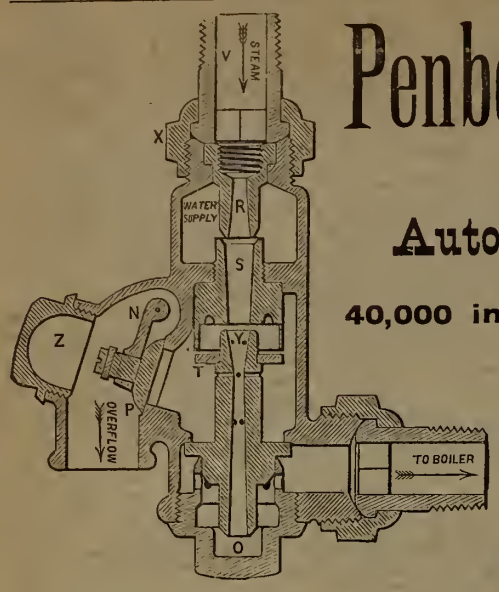

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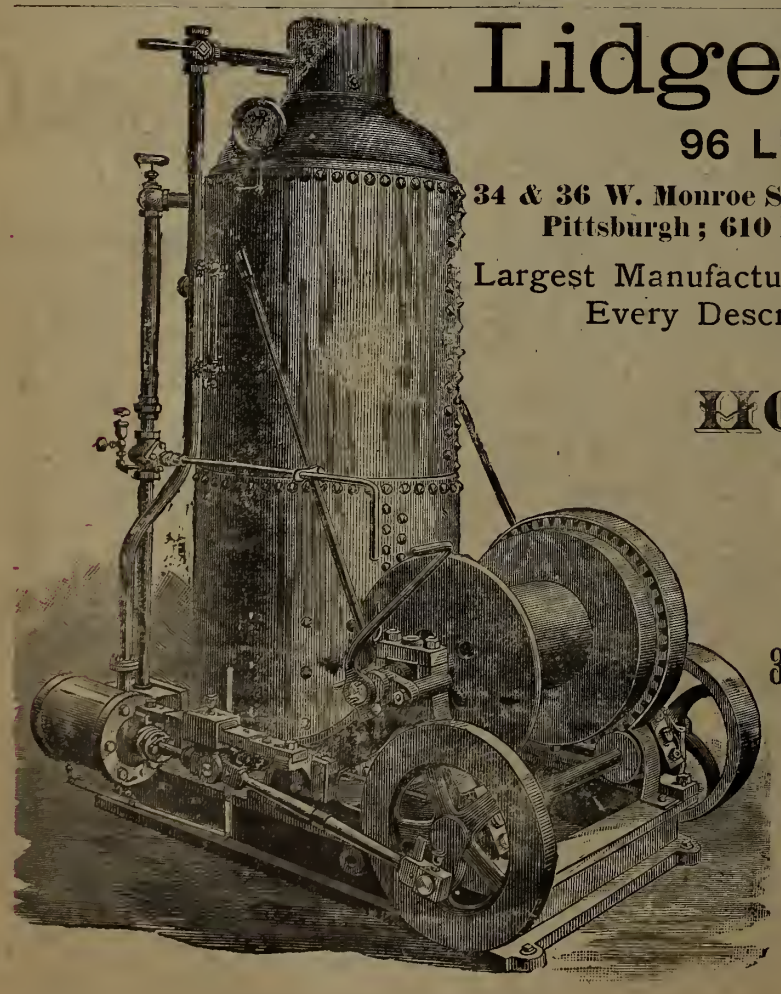

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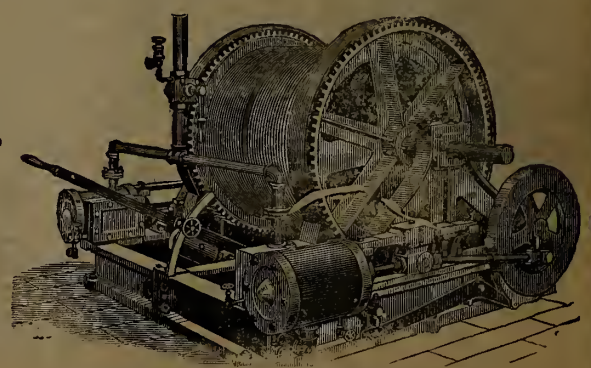

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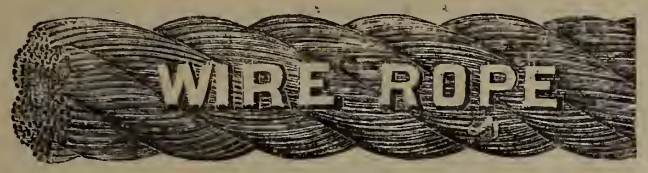

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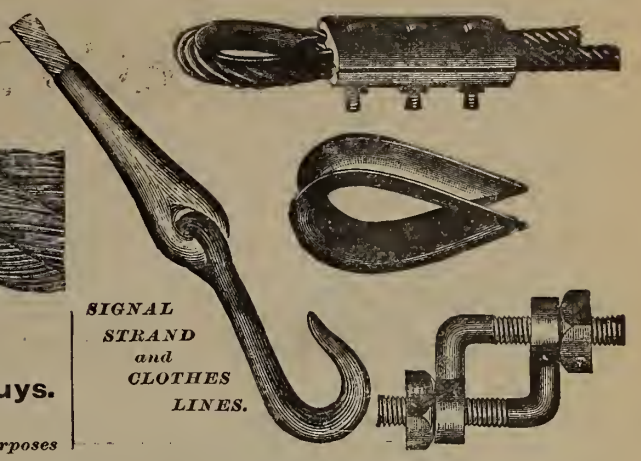

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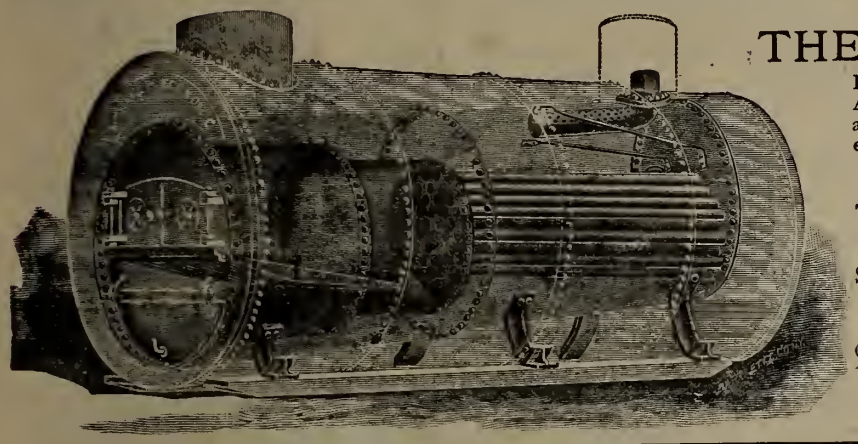

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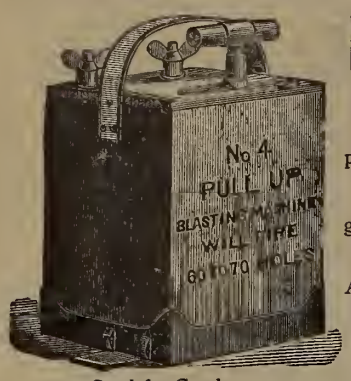

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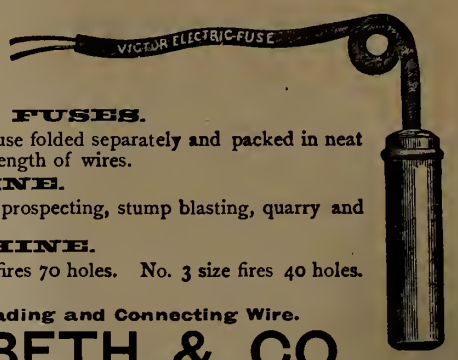

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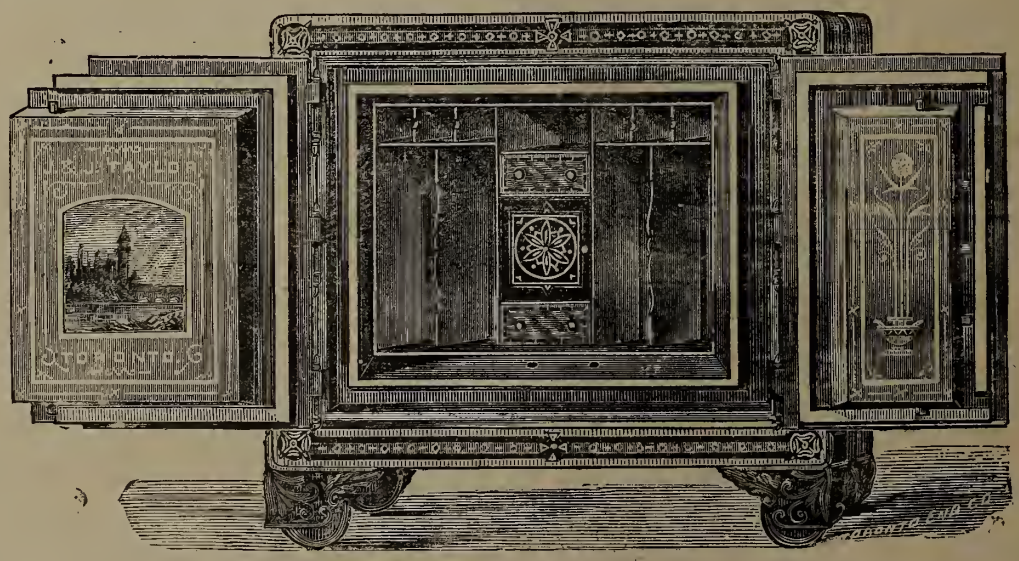

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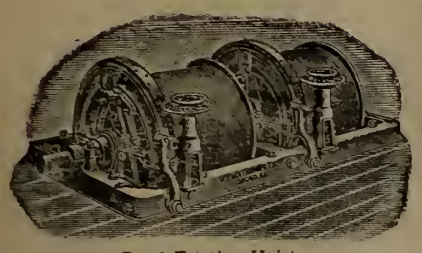

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Holes bored at any angle, and solid cores (or specimens) removed from all strata penetrated.

Hand and Horse Power Drills for prospecting in localities inaccessible to Steam Drills.

Power Drills (15 styles) adapted for boring from surface or underground to depths varying from

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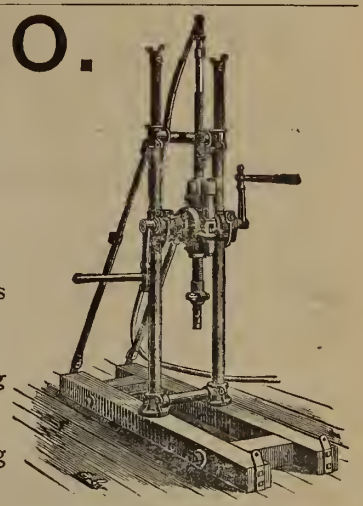

"Bravo" Hand Power Drill.
Capacity. 400 feet. 1 3-4", hole 13-16"

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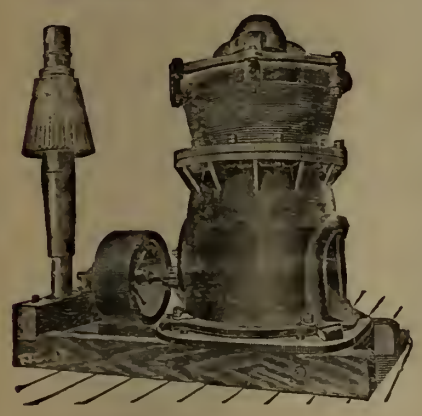

CAPACITY IN TONS OF 2,000 POUNDS.

Size 0— 2 to 4 tons per hour.
" 1— 4 to 8 " "
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" 3—10 to 20 " "

Size 4— 15 to 30 tons per hour.
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Passing 2½ in. ring, according to character and hardness of material.

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For prospecting Mineral Veins and Deposits, Boring Vertically, Horizontally or at any angle, to any desired depth, taking out a Cylindrical Section or Core the entire distance, showing exact character, and giving a perfect section of the strata penetrated. Also for Boring Artesian Wells perfectly straight, round and true.

Machines for Channelling, Gadding, and all kinds of Quarry Work, Shaft Sinking, Tunnelling, Mining, Railroad, and all classes of Rock-Boring.

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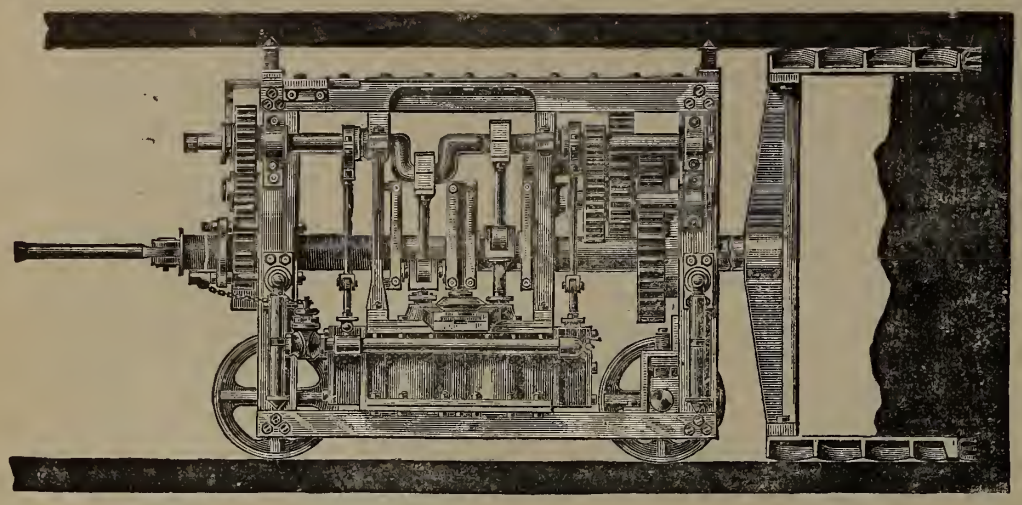
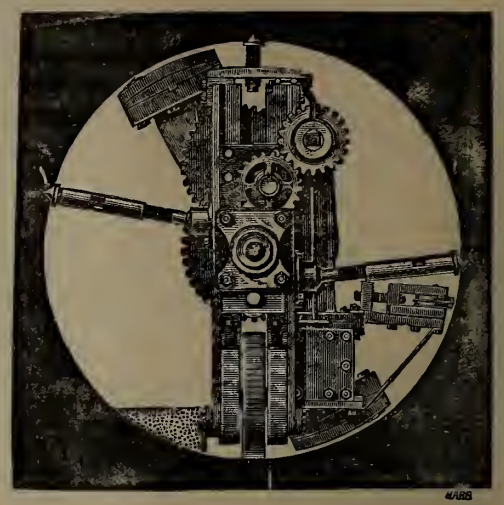
Some of the advantages as compared with hand labour are:—It greatly reduces the wages cost. Does work in one-fourth the time. Leaves much firmer roof. Economises use of timber. Renders explosives unnecessary. Ventilates its own head while tunnelling.

These machines are now working at a number of collieries in England, Scotland and the Colonies; in the United States, and in Several Continental countries.





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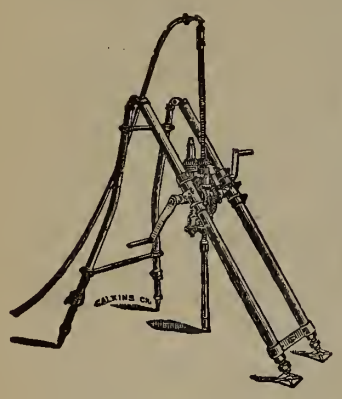

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Capacity—300 ft. depth.

Removes $1\frac{5}{16}$ inches solid core.

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PROSPECTING MINERAL LANDS.

The Sullivan Diamond Drill is the **simplest, most accurate,** and **most economical** prospecting drill for any kind of formation, hard or soft, in deep or shallow holes.

The Diamond Drill brings to the surface a **solid core** of rock and mineral to any depth, showing with **perfect accuracy** the nature, quality and extent of the ore-bearing strata, and with great **saving in time and expense** over any other method.

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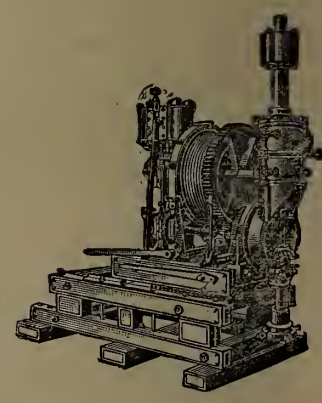

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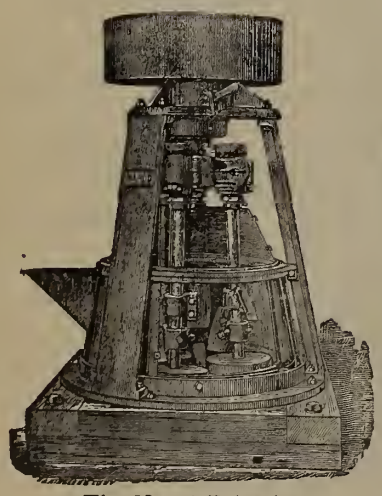
Capacity—2,000 ft. depth.

Removes $1\frac{1}{8}$ inches solid core.



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THE NAROD PULVERIZER.
THE NAROD GRANULATOR.

The Pulverizer produces from 20 to 150 mesh fineness. The Granulator from size of a wheat berry to 20 mesh. Fineness determined by size mesh of screen used in mill. Both mills take from Rock Breakers and deliver a finished product.

No Tailings, No Re-grinding, No Slime. Capacity Hard Quartz 2 a 3. Phosphates, Cements, &c., 3 a 4 tons per hour. Only 15 to 20 H. P. required. Weight of each Mill 5,600 Pounds.

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R. T. ROUTH, *Canada Sales Agent,*
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(Copy.)

Wilmington N.C., Sept., 21st., 1891.

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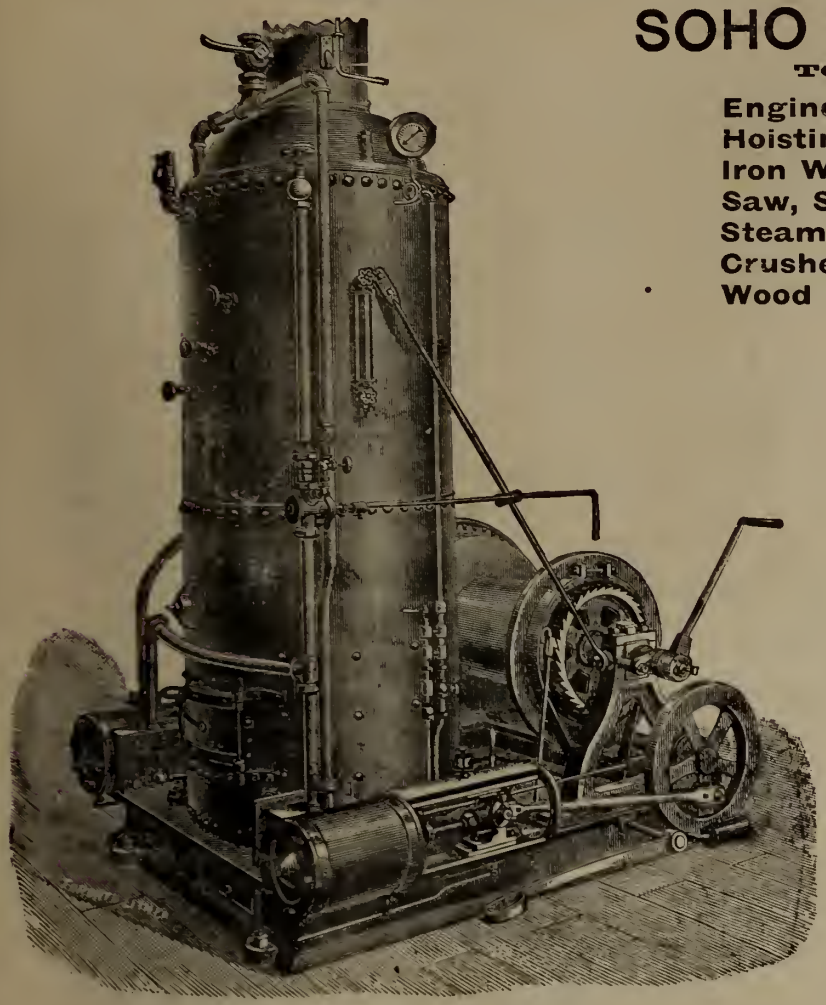

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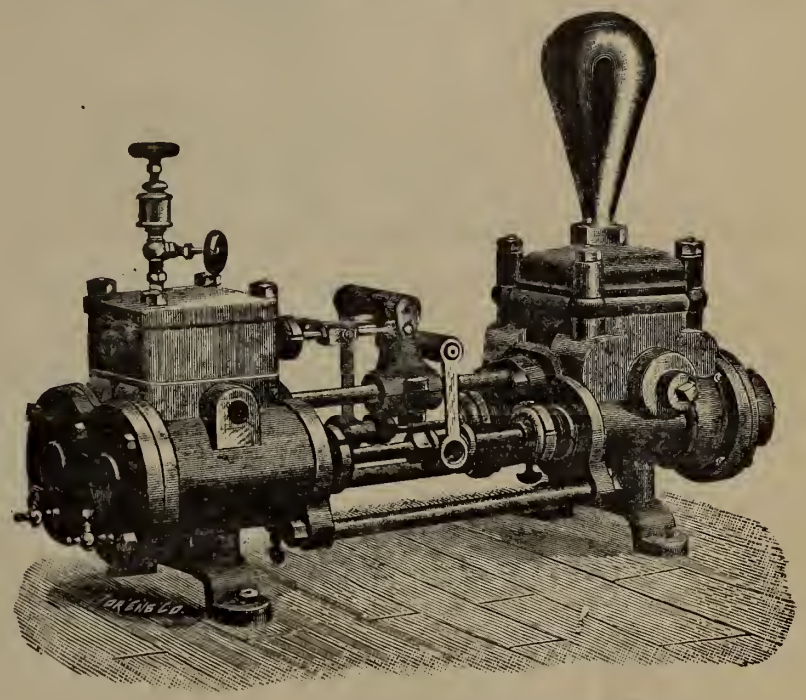

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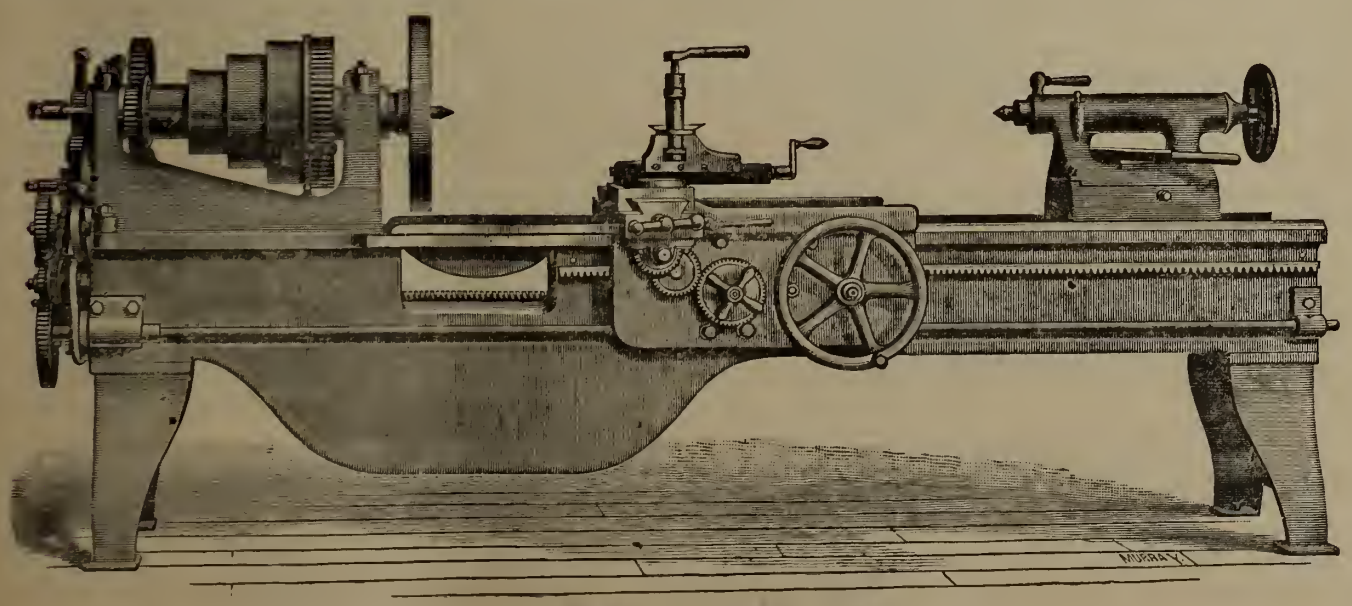

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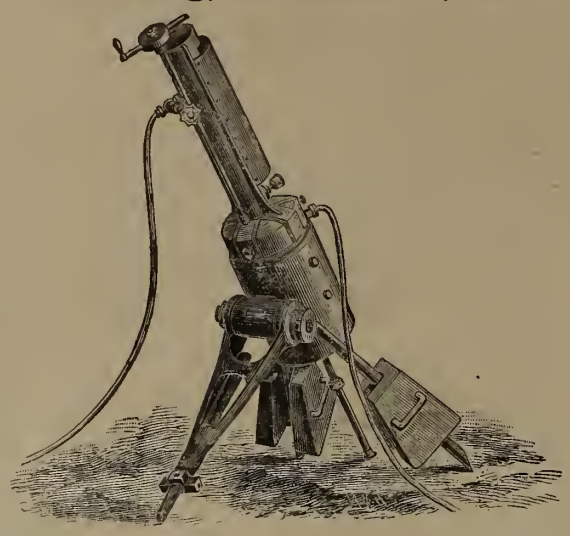

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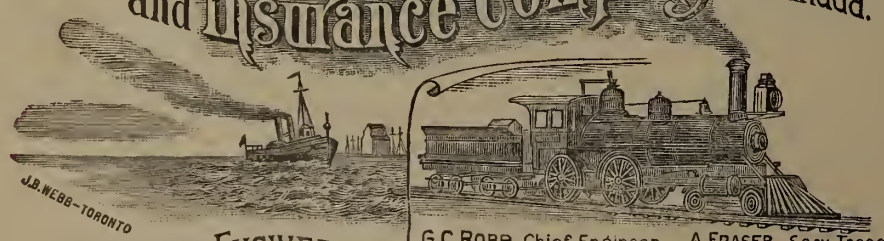

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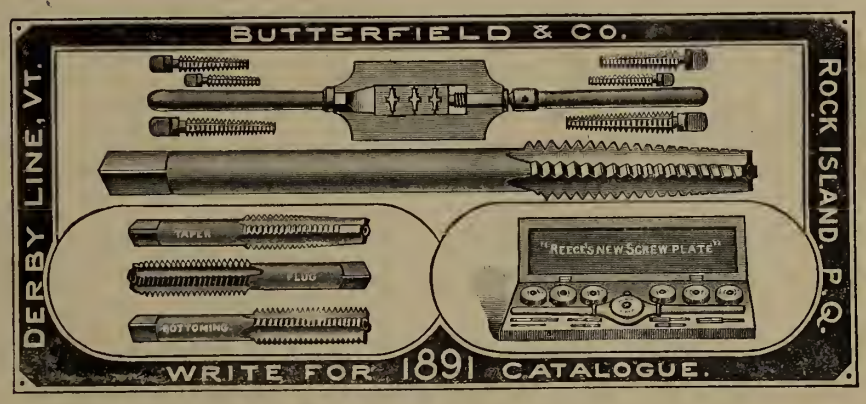

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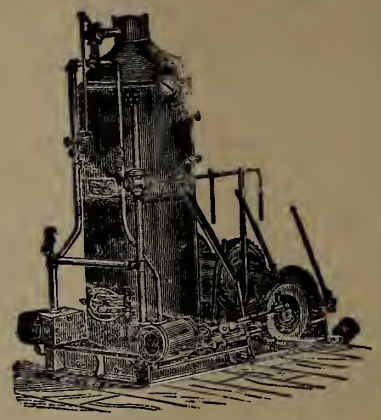

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Vol. XI. JANUARY, 1892. No. 1.

Nova Scotia Coal Mining in 1891.

During the year 1891 the coal business has been steady and satisfactory. This pleasing statement is marred only by the unfortunate explosion at the Springhill mines in the early part of the year, which destroyed over one hundred valuable lives. The coroner's jury, largely composed of practical miners, exonerated the Company from blame, and it would appear that the direct cause was a want of judgment on the part of the men having charge of the blasting. Mr. Cowans, the manager, set to work at once to repair the damages, and in a few weeks the mines were running as briskly as ever. In Pictou County work was fair, but not as btisk as expected. Cape Breton, on the contrary, had a very busy year. Pending the issue of the official figures of the Mines Department, an estimate of the total production places it at 2,046,000 tons, against 1,984,000 tons in 1890. The increase was divided between Quebec and Nova Scotia markets. The accident to the Springhill collieries shortened the output by some 35,000 tons.

In Cape Breton two mines have been reopened; the Sydney and Louisburg having reopened and remodelled the Lorway mine, and the Burchell Brothers having leased the Gardener mine from the Merchants' Bank. These two pits will yield about 800 tons a day. At the latter the Jeffrey electric coal cutter has been introduced with success, and at the former it is reported that a large plant of air-driven coal cutters will be ready for the spring trade. It is reported that this example will be followed by the Caledonia Colliery. There can be no doubt that the general adoption of mechanical coal cutters will lead to the introduction of long-wall methods of working, to the saving of coal and its improved quality when shipped. At several of the mines mechanical ventilators have been built, as the furnaces with shallow upcasts were found too weak to cope with the long airways. The International Company's railway now operated as a part of the Cape Breton (Government) Railway, has greatly improved its equipment, and has added two new locomotives to its rolling stock, one of which bears the name "Louisburg," as phrophetic of the near extension of the road to this all-winter shipping port.

In addition to the regular work at the mines, much prospecting and preliminary work has been carried on. The Sydney and Louisburg Company have leased about six square miles, covering, it is reported, the outcrop of a new and valuable seam. An American company is sinking on a seam of coal at East Bay, reported to be a good quality of anthracite. The Terminal City Company and others have done a good deal of work in the River Inhabitants district, and at Mabou Col. Snow has opened a bed of good coal for local sales.

In Pictou County the Acadia Company has continued the work of reopening the Foord pit, and have put up steel pit head and pulley frames, and have introduced a belt for cleaning the coal on. They have also put up a new winding engine at their Westville colliery. The Intercolonial Coal Company has also erected a large winding engine, built in Sherbrooke, Que., and have shown that coal miners need not go outside the Dominion for winding engines of the largest size and the best construction. The work of extracting the pillars from the Black Diamond Mine, nearly completed, will be finished by the Acadia Company, which has absorbed it. The New Glasgow Iron and Coal Company expect to make coke containing not over 12 per cent. of ash, by washing the culm from the Pictou collieries, and are now building a block of thirty Coppé ovens at their furnace site at Eureka.

In Cumberland County the Joggins mines have been put in good order, the wharf has been extended into deeper water, and the incline from the slope to the shoot improved. Extensive explorations have been carried on in the Maccan district, which have proved the extension of the seams a considerable distance east of points they were hitherto known to exist. At Springhill a new self-acting bank-head has been built at the west slope. All three slopes have been retimbered, air-ways enlarged, etc. Although many parts of the mine are not known to give off gas, safety lamps of the most approved type have been introduced all over the mine and the use of gunpowder done away with. In this connection it may be remarked that in Pictou County gunpowder has been almost entirely supplanted by roburite, as affording much greater safety. Other safety explosives are being experimented on, and in a short time it is expected that the more gaseous of the Cape Breton mines will be obliged to discard gunpowder. Extenslve shipments have been made from Springhill, via Parrsboro, to St. John, Portland, etc.

The mining legislation of the past year has been novel and important, and again places Nova Scotia in the lead of other mining countries. The use of gunpowder has been forbidden in gaseous mines, and regulations made for the introduction of flameless explosives. Fortnightly pays to miners have been made compulsory. Coal miners are now required to have certificates showing their knowledge of mining, gas, etc., before they will in future be allowed to work on their own responsibility. Engine men, entrusted with the duty of raising and lowering men in the mines by machinery will be required to hold certificates of competency. Boys will not be allowed to work over fifty-four hours in any week, unless over sixteen years of age, nor shall any boy be allowed to commence working in a coal mine unless he be able to read, write, and has an elementary knowledge of arithmetic. As the overmen and underground managers are required to pass examinations before obtaining positions, and are provided with instructors by the Government, and the same power provides for the institution of night schools whereever wanted in the coal districts, it may readily be believed that with steady work and fair pay the coal miners' occupation in Nova Scotia should be a happy one.

Nova Scotia's Gold Industry in 1891.

From the best data at hand at this writing, the product of gold in Nova Scotia for 1891 was in round numbers 21,500 ounces, or $420,000. The product for 1890 was 24,350 ounces, or $475,000.

This falling off was anticipated (see our issue of January, 1891), but proved fortunately to be less of a decrease than was at that time threatened. The two districts of North Brookfield and Central Rawdon alone show a decrease of over 3,000 ounces. This was due, as regards Brookfield, to a cessation of work, caused by internal troubles of the company operating; as regards Central Rawdon, to the exhaustion of the pay chute, which had been much overrated.

Nine districts yielded over 1,000 ounces each, and four yielded over 2,000 ounces each. Of these, Malaga is easily first, producing over 4,000 ounces as the product of three mines, viz: the Boston Gold Mining Co, the Malaga Mining Co., and the Parker-Douglass Co.

The Oldham district comes second, with a production of nearly 3,000 ounces, of which 2,400 was produced by the Standard Gold Co. alone.

Uniacke (which includes the older district of "Mount Uniacke," and the new one of "South Uniacke,") and Fifteen Mile Stream, come about even, the product of each being about 2,500 ounces. The principal producer in Uniacke was the Thompson-Quirk mine, and in Fifteen Mile, the Egerton Co. This latter company has made an enviable record during the past two years, its grade of ore being much lower than that of any of the other companies mentioned.

It is possible that Montagu may reach the 2,000 ounce mark, but from the returns made to date it will fall short.

Amongst the more prominent mines showing a decrease for the year, besides Brookfield and Rawdon already noted, is the Salmon River mine, showing a decrease of over 500 ounces.

Waverley District repeats the story of last year. A big lot of money has been spent, and a very small return has been made. Another big plant has been built, but has not yet got to producing. There are rumors locally of the introduction of a tremendous English capital and a big consolidation, which rumors gain credence from the fact that a consolidation of the five principal properties in Montagu has been united with a property in Waverley, and the whole floated with a big capital (£120,000) in London. The

Montagu properties are valuable, and if properly managed will change the experience of English capital in Nova Scotia gold mines, which has hitherto been uniformly disastrous, to a successful exception.

Sherbrooke district has remained practically idle. During the last few weeks of the year, however, some slight stir has been felt, and several efforts, backed chiefly by local capital, are being made to once more exploit what was once the principal district of the Province. It is confidently expected that 1892 will see Sherbrooke brought forward again into the ranks of a steady producer.

The year has been marked by the collapse of the "conglomerate" boom. Gay's River has been equipped with a fine 50-stamp mill, and some 500 tons of conglomerate have been milled with the average result of about $1.50 to the ton. The result was not unexpected by those competent to judge, but their opinion was never asked by the company, with the single exception of a New York expert, who was too honest for the company, for he predicted failure. The collapse of the Brookfield and Stewiacke conglomerates was also fore-ordained, and occasioned little comment. The extent of these crazes may be judged somewhat when it is stated that the receipts of the Mines Department for leases and licenses was some $5,000 less in 1891 than in 1890, which decrease is almost entirely due to the subsidence of the conglomerate craze. The partial lunacy now prevailing, as to the existence of alluvial gravels bearing gold in paying quantity, will disappear, we predict, before our review for 1892 makes its appearance.

Much new machinery of modern type has been put in by different companies, and the use of air drills is spreading rapidly. One concern has been venturesome enough to put in (conditionally), an electric percussion drill. The new mills built are, with few exceptions, of the best modern type, one water-mill having reduced its cost of stamping to 30 cents per ton.

The field for good investment afforded by our gold mines is obvious to the honest critical observer and engineer. But such investments of capital must be carefully proportioned to the actual demonstrated value of the properties acquired and the necessary working capital, economically administered. The reasons why so many foreign investors have come to disaster here are patent: lack of intelligent management; the substitution of foreign engineers for local men of equal knowledge and vastly more experience in these particular deposits; over capitalization, and extravagant ideas of the necessary plant. All these and others are sign posts along the road which foreign capital has traversed in the past.

Our American cousins are bad enough in this way, but our British brothers are more careless yet.

"It is always the unexpected which happens," yet we think the year 1892 will not see a very much increased production over 1891, the steady producers are getting deeper every year, and those working on shallow pay chutes will have a season of dead work, which will diminish the output somewhat. ***

An Important Decision.

The judgment of the Supreme Court in the case of Holland Bros. vs. Ross Bros. is one which may have far reaching consequences. It virtually decides that the Department of Crown Lands has in thousands of cases exceeded its powers in confiscating properties purchased prior to the passage of the first Public Lands Act by the Provincial Legislature after the confederation of the provinces.

The case arose in this way: The late Mr. W. L. Holland was one of the original settlers in the Priest Creek Valley of the Township of Portland West, Ottawa County. He purchased 200 acres for himself and 200 acres for each of his two sons. The two lots bought in the name of his younger son were situated at some distance from his own, and he obtained permission from a representative of the Department to make the improvements for all the lots on the homestead where he resided. Acting on this understanding, the Department granted the patent for the lots in the name of the elder son as soon as all the purchase money was paid. Some years later the younger son completed the payments for his lots and transferred the title to his father. The transfer was duly registered in the books of the Department and the registration fee of $5 was demanded by the Commissioner and paid by the owner. Shortly afterwards the late Mr. William Holland forwarded to the Department an application for his patent, accompanied with the usual patent fee. To this application he received no reply, but sometime afterwards was astonished to learn that a notice appeared in the Quebec Gazette confiscating the lots, Nos. 11 and 12, in the 4th Range of Portland West. He at once protested against the cancellation, and appealed to the Department to give him an opportunity to establish his good faith. The Department refused to grant him a hearing. He then gave notice that he had proceeded to the property in question with a force of men and was engaged in making such improvements as the Department might require. Again the Commissioner refused to recognise his right to the ownership of the property. An expensive appeal to the Governor-in-Council was equally futile. The following winter, under authority from the Department, Messrs. Ross Bros. of Quebec, cut the pine timber on the land, the owner protesting and threatening an action. In 1880, Holland Bros. entered a suit against Ross Bros. for the value of the timber cut and removed from the property. Ross Bros. set up the plea that the lots, having been confiscated by the Department, and having been restored to their limits, they were the owners of the timber. The Superior Court decided against their contention and awarded damages and costs to Holland Bros. From this decision the Quebec Government, in the name of Ross Bros., appealed to the Court of Queen's Bench, which, by a unanimous decision, on a false representation of the facts, reversed the judgment of the court below. From the Court of Appeals the case was taken by Holland Bros. to the Supreme Court at Ottawa, and in November last that court decided with but one dissenting voice that the Department had exceeded its powers, and sustained the original decision, with costs in all the courts. The case has been settled, the Department having decided to carry it no further.

As thousands of acres in the phosphate district of the Ottawa Valley were confiscated, under very similar circumstances, during the Joly *regime*, it is highly probable that a prolific crop of lawsuits will arise out of this important decision. Many of the confiscated properties have since been sold at high prices as mineral lands, and on some of them valuable phosphate beds have been discovered and worked. With the decision in the case of Holland vs. Ross to guide them, the original owners can demand damages from the Department for the losses they have sustained through the confiscation of their lands. We know of many instances in which lands purchased prior to Confederation, and on which payments had been made, were confiscated because, in the opinion of some irresponsible employé of the Department, the improvements were not up to the standard called for by the original location tickets. In all those cases the only ground on which cancellation was possible, as stated in the location ticket, was "violation" of the conditions of settlement. Mere failure to comply with the conditions of settlement was not, until long afterwards, made a ground for despoiling the owner. All the cancellations took place under legislation of the Province of Quebec subsequent to 1867. The view held by the Supreme Court in the case of Holland vs. Ross, was, that the registration of the transfer from the original purchaser to Mr. Holland senior constituted a waiver of any claim that the Department might have against the owner for failure to comply with the settlement conditions. There were other grounds on which the case was decided against the Department, but the court held that this last was sufficient to annul the order of cancellation.

Whatever the ultimate consequence of the decision in this important case may be, everyone who has had anything to do with the Crown Lands Department of Quebec will rejoice to know that the petty tyrants who, by virtue of their official positions, have power to annoy and blackmail the unfortunate public with whom they come in contact, have at last received a check which may make them a little more cautious how they push their official powers to an extreme in the future. In the general cleaning out of the Augean stable at Quebec, the Crown Lands manger, which has been foul with corruption from the very dawn of Confederation, requires special attention. It is hard to conceive how an improvement can be made while the existing heads of the several offices, who have grown old in vicious practices, remain: a complete change of the older officials is indispensable to the efficient and and honest working of the Department. This, let us hope, will be one of the first tasks to which the new Government will address itself after the general elections.

Nova Scotia Explosives Commission.

Reference was made some time ago in our columns to the appointment of a Commission by the Government of Nova Scotia, to examine into the question of replacing gunpowder by an explosive equally effective but less dangerous in the presence of gas and dust. The question was forced upon the Government owing to the inquest upon the Springhill disaster proving that the immediate cause of the explosion was due to the flame of a charge of gunpowder used in blasting. The Commission, with the Inspector of Mines as chairman, has had several meetings and has experimented with the most promising explosives in the Pictou and Cape Breton mines. The results are not yet known, but it is understood that two explosives have proved satisfactory so far. One of these is roburite, already well known in England, although not yet officially endorsed by the British Government; the other is understood to be similar to the mixture of dynamite and nitrate of ammonia approved of by the French Government as having, when detonated, a temperature less than that of the ignition of fire damp. As the exact compositions of these explosives calculated to be safest for coal mining have not yet been settled, the labors of the Commission are still unended. This subject is one of great importance, and has been studied by many of the leading chemists of the present day. The report of the French Commission is considered the most valuable contribution to the literature of modern explosives. They started out to find an explosive which, when fired in a mine, would not produce heat enough to ignite fire-damp. After researches and experiments extending over several years, they have announced four such compounds. Two of these have hitherto appeared desirable to the Nova Scotia Commission. If the further investigations of this Commission, which appear to be deliberately and carefully conducted, result in giving the public a safe explosive, the Nova Scotia Government will have rendered a great service to the coal mining industry of the continent. Undoubtedly public opinion in the United States will follow that of Nova Scotia and demand that where gas is found in coal mines a safe explosive must replace gunpowder, and as the difference in cost of these explosives as compared with gunpowder is pound for pound, inconsiderable operators will not be able to raise the cry of increased cost of production. It is understood that as soon as a definite conclusion is reached by the Commission, the miners of British Columbia who have suffered from explosions will demand at the hands of their Provincial Government a similar measure of protection.

Mr. Haggie, a young colliery manager at Rotherham, in Yorkshire, has had his certificate suspended for twelve months, for having allowed an air pipe to be cut in two, thus destroying ventilation at a time when several persons were in the mine.

EN PASSANT.

At a recent meeting of the mining section of the London Chamber of Commerce, the imposition of the royalty system was condemned. One of the speakers contended that the principle should be adopted of paying royalties out of profits, or by tonnage, or by some other fair means.

In another place our readers will find a very complete report of the proceedings of the Second Annual General Meeting of the General Mining Association of the Province of Quebec, with all the official correspondence between the two Governments anent the Petition to disallow the Quebec Mining Act; verbatim reports of the papers read, and the other features of a very successful and memorable occasion. The Association has proved itself an important factor in promoting good fellowship among the members, and its record as a worker is distinctly creditable. It enters upon its second year equipped with an efficient board of officers, a satisfactory balance sheet, a healthy increase in membership, and the hearty good will of every one interested in the advancement of the industry in Quebec.

We have to acknowledge from the publishers, the Scientific Publishing Company, New York, a copy of Dr. Sterry Hunt's latest book, "Systematic Mineralogy." The aim of the author in this treatise has been to reconcile the rival and hitherto opposed chemical and natural-historical methods in mineralogy, showing that when rightly understood, chemical and physical characters are really dependent on each other and present two aspects of the same problem which can be solved only by the consideration of both. He has, moreover, devised and adopted a Latin nomenclature, and arranged the mineral kingdom in classes, orders, genera and species. The price of the book is $5.

The increasing interest in mining in Canada is illustrated by the number of companies formed during the past year, which is ninety, against sixty-one in 1890. The total capital for 1891 being $30,794,000, as against $19,637,750 in 1890. The material interests of the several provinces are advanced—In Ontario by thirty-three companies whose capital is $15,633,000; next comes British Columbia with twenty-five new enterprises, having capital to the extent of $10,535,000; Nova Scotia has fourteen companies with a capital of $1,700,000; Quebec has gained thirteen with a total capital of $2,740,000; New Brunswick has three new enterprises with $116,000 capital in all; and Newfoundland has two companies with £450,000 stg. capital, which is not included in the total for the Canadian Provinces. These figures are satisfactory and encouraging, and show the steady annual increase in mining enterprises of all kinds, although the past year cannot be said to have been one of great commercial activity. A complete list of all companies formed in each province will be found on another page.

Mr. O. M. Harris, Montreal, who has been for a number of years back the Canadian representative of Messrs. Millar & Co., London, and the Canadian Phosphate Co., has opened out on his own account as a shipping agent and general mineral broker. Pushing, enterprising and popular, possessing an intimate acquaintance with the requirements of the trade, and backed up by a good connection, Mr. Harris should do well. O. M. is a good fellow, who carries with him the best wishes of the REVIEW in his venture.

Mr. G. D. Jennings, of the Anglo-Canadian Phosphate Company, London, having noticed the comments of Mr. W. J. Morris on his letter to us, on the position of the European phosphate market, and which we noted at some length in our last issue, writes: "Evidently the sanguine Mr. Morris deals rather in probability and in prophecy than in facts, and the controversy is, therefore, hardly an equal one. The facts of the market are as stated. Manufacturers will only use what they think they want, and no reasoning will make them buy 80% Canadian when they want 60% Bull River. Still our interests are altogether in Mr. Morris' being right and it is only because I am not a licensed prophet, and therefore do not prophesy until I know that I do not indulge in the sure and certain hope of a fortune next June."

Our exchanges from the Western States, give very glowing accounts of the mining convention which took place at Denver, Col., lately. Miners from all over Colorado walked in procession in company with mine owners and mine brokers, with bands, floats, etc., all representative of the mining industry. The procession was nearly a mile long. The Inter-State drilling contest was the feature of greatest interest to the working miners. There were 23 teams entered for the double-handed contest, nearly all from Colorado camps. One team from Butte, Montana, carried off the prize. There were 23 teams in the single-handed contest. In the double-handed contest the Butte boys each handled the hammer for a minute and then changed to turning the drill and only lost two strokes during the entire fifteen minutes. They put down a hole 29 15-16 inches in the allotted time, and the audience was enthusiastic when the result was announced. The rock selected was Gunnison gray granite, which is being used in the capitol building, and is counted the hardest obtainable in the State. In the single-handed contest, one man drilled 18 11-16 inches, the next man getting only 13¾ inches in the same time.

As showing the enormous sums of money which have from time to time fallen into the hands of individual Cornish families owning land upon which mines have been sunk it may be of interest to state that for a considerable period the Basset family took up, by way of dues, between £30,000 and £40,000 per annum. This family still have all the dues from five of the most important mines in England.

The Belleville Natural Gas and Oil Company, after spending some $2,200 in a futile endeavor to strike gas or oil in the city of Belleville and district, has abandoned the project as a bad job. This is but another instance of the misguided and ill-directed application of capital unfortudately too prevelant in this country. Enquiry at the Geological Survey, or the opinion of a mining engineer conversant with the geology of the district, would have prevented this very foolish venture.

The National Association of Colliery Managers has lodged a strong protest with the British Government against the practice of appointing working miners, whose only qualification is experience in some of the detail manual labour underground, as inspectors over certificated managers. The Association points out with truth that such persons should at least be equal to the managers in practical and scientific knowledge in all departments of the mine; otherwise inspection must be abortive. Appointments of this kind inflict not only a serious injustice upon the managers, but, by reason of the incompetency of the inspectors, introduce grave dangers in working the mines.

The sale at auction of the Estates of the White's Asbestos Company, announced in another place, is the last act in a notorious swindle. Originally bought for a few hundred dollars, then unblushingly unloaded on the credulous Englishman, away up in the thousands of pounds, we are curious to know the ultimate figure to be realized for these lands—or if a bid will be made for them at all. It is certainly a misnomer to call them "asbestos lands," for, as the unfortunate investors learned to their cost, the property contains as much of the mineral as "Paddy shot at." Intending purchasers should read up the history of the case in back issues of the REVIEW.

Mr. C. F. Scott lately read a paper before an engineer's society in Pennsylvania, in the course of which he instituted a comparison between hand labour and electric machine labour for coal mining. In machine mining the stalls can be made much wider, because of the greater rapidity of mining, so that the roof will have to stand a shorter time with fewer pillars. The direct effect of coal cuttiug machinery is to reduce the cost of undercutting from 1s. 8d. to 5d. per ton of 1½-in. coal in the Pennsylvania district. Taking into account the other expenses, Mr. Scott says there is a saving of 25 per cent. Another advantage of machine mining is that perfect pillars are left and can be recovered, as there is no temptation to rob them. The reduction of the number of stalls for the same output, due to machinery, also effects a great saving in the timber used, the number of roads, and the tramways that have to be maintained. The saving in coal, due to the introduction of electric machinery, is said to be great, An estimate is given of the saving in expense by using a plant of seven machines, run ten hours a day, and cutting 233 tons. The cost of these would be £29 11s. 3d., while the cost of hand mining for the same number of tons is £38 6s. 8d., a considerable difference in favour of the use of machines.

From returns furnished officially, the exports of silver ore and bullion from Port Arthur mines during the past year were:—

	ORE.	BULLION.
January	$ 15,000	—
March	39,000	$10
May	13,000	—
July	44,113	—
August	37,050	—
September	27,050	—
October	35,370	—
November	9,800	—
	$220,383	$10

Of this, ore to the value of $220,200, went to the United States.

In a paper entitled "Notes on Recent Accidents from Blasting in Coal Mines," read before a recent meeting of the Manchester Geological Society, Mr. James Ashworth, M.E., offered the following suggestions: "(1.) That every explosive now in use in mining operations should be tested by ignition with a bare fuse without a detonator, safety cartridge case, or water cartridge, and with coal or carbonaceous tamping in a dusty atmosphere. The bore-hole to be (*a*) of 2 inches diameter, and (*b*) of say 1 inch diameter, or of such diameter as give the area of the hole proportionate to the strength of the explosive as compared with ordinary blasting powder. (2.) That a similar course of experiment should be conducted with a current of air of high velocity, not less than 30 feet per second impinging directly on the bore hole. He made these suggestions because the use of high explosives in coal getting has resulted in their being applied without any attention to the question of leverage—that is to say, when a 2 inch diameter hole has been used for blasting powder, a 2 inch diameter hole has been continued for high explosive, hence, instead of occupying say eight or more inches of the length of the hole, the high explosive occupies say one or two inches, and the pressure exerted is as great or greater on the tamping than on the side of the hole where the removing should take place. He therefore advocated: (3.) That high explosives should be applied in bore holes of a diameter proportionate to their strength as compared with blasting powder, because, as he observed in an earlier part of his paper, 7 inches of tamping in a 1 inch diameter hole is as effective as 18 inches in a 2 inch hole. He pointed out that the worst disasters from blasting have always occurred from shots which faced ventilating currents of high velocity. A *detonating* vibration appears to be created under such conditions, whereas if the force of the shot goes with the current, it is not created. (4.) That no explosive is safe for use in a dusty or gaseous mine, if its detonating vibration is like that of a mixture of coal dust, fire damp and air."

"They are aye in a hurry that the deil chases," was the apt quotation of a canny Scotch colliery manager in commenting upon the eagerness of the producer of to-day to make large outputs. He remembered when the Benhar Coal Company, Limited, paid their first dividend of 15 per cent., the managing director said to a fellow director, a most noble, worthy man, now deceased, that he was going to raise his output, and do better next time. His fellow-director replied that if he would drive a "wee cannier" he would pay 30 per cent. next time. When we consider the falls of roof, the breakages of haulage ropes, the breakages of pumps and machinery, the want of waggons, sudden changes of the barometer and what it it implies, the want of order, indifferent workmen, and the thousand and one things that cause stoppages about a colliery, then we see the necessity of reducing these to a minimum, and we may safely infer the greater the pressure the greater the risk of stoppage. He did not think that anyone would contradict him when he said, for the sake of illustration, that a colliery working twelve days a fortnight, and producing, say, 3,600 tons in that time, will be a more profitable concern than one producing that quantity in ten days, for various reasons. First, because fewer oncostmen will do for twelve days than for ten, less area of working face will provide the output, the work will be better done, and the salesman will have twelve days to dispose of the output instead of ten, the waggons will be running all the time instead of standing two days idle per fortnight, and anyone with a large number of waggons will know what that means at the end of the year. Instead of requiring from 700 to 720 waggons in ten days the same number will do for twelve days. Besides all that, look what an advantage it would be to our nearest and best allies, viz., the railway company, who take away our traffic. When we consider all this, what an enormous waste of capital expenditure is exhibited—first, to the colliery company for extra houses, for extra workmen, for extra waggons, for extra plant of every kind; and then consider the railway company for extra engine power, for extra waggons, for extra time. The more he thought of this subject the more convinced did he become that workingmen should have more consideration for these things, as it would be sure to redound to their credit if they would do so. When we think of the extra danger that is incurred in opening out a gaseous seam of coal too rapidly without giving the gas proper time to drain, when we think of the enormous stir and bustle at the top and bottom of the shaft and on the haulage roads, the lightning speed of the cage in the shaft, double, and in some cases treble, shifts, and the great rush everywhere about the colliery, the risk of accident is greatly increased. The first and primary duty of every colliery manager is safety, and he should do everything in his power to co-operate with anyone who can instruct or help him in any way to make his colliery more safe, and reduce the number of accidents to a minimum. Greater knowledge and greater experience have considerably reduced the number of accidents for the past few decades in proportion to the output raised; and he for one was of the opinion that a little less hurry to produce a large output would still further reduce them.

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. 15.

Mr. J. Burley-Smith, M.E., Manager of the Squaw Hill and Aetna Phosphate Mines, Buckingham, Que.

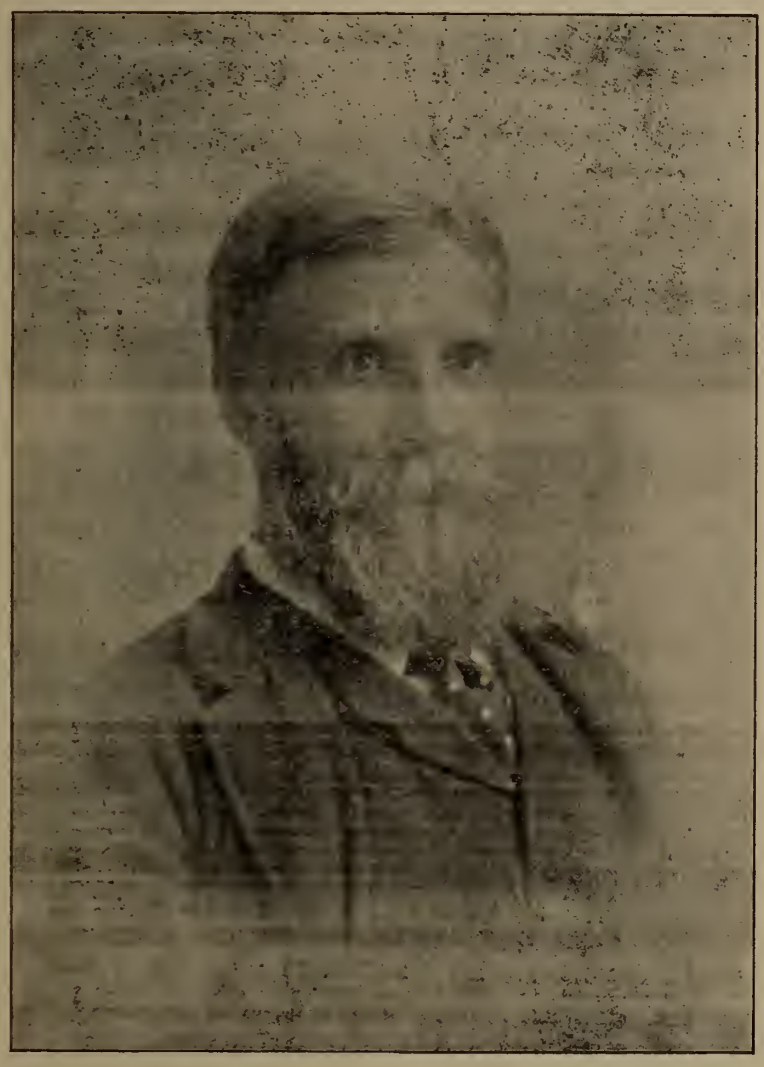
Mr. J. Burley-Smith, the subject of this brief sketch, is the Canadian representative of the Anglo-Continental Guano Works Co. of London and Hamburg, one of the largest miners and manufacturers of phosphates and phosphate manures in the world. He was born in the mining and quarrying districts of Derbyshire, one of the smallest of the English Counties, yet containing in its limited area, perhaps, the most varied and prolific mineral zone of Great Britain, the ancient lead, calamine and ochre mines of the Peak, with its fringe of limestone and marble quarries, being but a few miles from the great coal and ironstone measures of the North Midland and Erewash valleys. Mr. Smith was educated both as a mechanical and civil engineer, gaining valuable training and experience in the drawing office and workshops of Messrs. Andrew Handyside & Co., Limited. at Derby, a prominent establishment, whose chief work at that period was the construction of heavy pumping and winding engines for colliery and other mining work. On the completion of a six years' indenture as apprentice, Mr. Smith received an appointment from this firm as outside superintendent, and for some time had charge of many of its most important undertakings.

As a civil engineer Mr. Smith was employed in the Central Engineer's Bureau of the Kaschon Oderberg railway at Pesth, in Hungary, and later on was sent out as assistant engineer in the actual construction of their 300 miles of railway in the Carpathian Mountains; a line including in its route some of the most difficult tunnelling work in the world and opening out into a rich mineral district.

In 1871 Mr Smith returned home to England, and after devoting some short time to study, received an offer of an appointment as engineer with the Bilbao hematite iron mines in Spain which, however, he refused, in preference to an appointment as manager of the Buscombe hematite mines in Somersetshire. After having opened out the properties and placed them in good working order, he received the position of manager of the Kingswood iron mines in the same district, at which he remained for a period of some five or six years, during which he made several important discoveries of lead, iron and yellow ochre, as well as a very rare deposit of terra-cotta clay, lying in a recess of the limestone covered by a mass of dolomite conglomerate, in the Mendip hills.

At the end of this period Mr. Smith was sent out by Messrs. Lane Bros., Bristol, to examine and report on the mineral resources of the south west of Ireland, where he remained for some eighteen months and opened out for the firm an important slate quarry at Rossmore, Dunmanno Bay.

On returning to England he received the appointment of consulting mining engineer to the Ingersoll Rock Drill Co. of London, and for several years Mr. Smith had an interesting occupation in first introducing this well known machinery in many of the leading mines and quarries of Europe.



Yours very truly

J. B. Smith

About this period Mr. Smith invented and patented a channelling machine for rock cutting, chiefly for use in marble and slate quarries, and by which the blocks were cut out of the solid without blasting. This machine he exhibited in operation at one of the exhibitions in London, afterwards selling his rights to an American firm. As Mr. Smith says, he may very reasonably be claimed to be the originator of the gadding and channalling machines now so largely used in the United States and elsewhere.

A few years ago, at the request of the Countess Elise, he prospected her estates at Ventinuglia, in Italy, for minerals, and made several very important discoveries of mineral thereon.

On the expiry of this work Mr. Smith was engaged to survey and plan the estate and works of the Copper Miners' Tinplate Co., Croin-Avon and Neath, in South Wales.

Mr. Smith was a member, some years ago, of the Bristol Geological Society. He studied chemistry and metallurgy at the Onslow College, London, and attended the evening classes at King's College, London. He gained a first-class certificate in the University Extension examination in Electrical Science, having studied under Professor Laut Carpenter, of the Electrical Engineering College, Hanover Square, London.

In 1889, Mr. Smith had arranged a small prospecting party to go out to South Africa, as a gold mining venture, but owing to the illness of one of the party it fell through.

In 1889, the Anglo-Continental Guano Works Company, purchased the Squaw Hill and Aetna phosphate mines at Genalmond, on the Lievres River, Que., and among many applicants for the position of manager, Mr. Smith was selected. He has been with us since that time, and has prominently identified himself with the mineral interests of the Province, being one of the most zealous and active workers in the General Mining Association, of which he is a highly esteemed member of Council.

Mr. Smith's geniality, gentlemanly bearing and generous hospitality, have won him many friends, all of whom join us in wishing him good luck and every prosperity in his present undertaking.

The following comparative statement gives the crushings of the Witwaatersrandt gold mines up to the middle of November :—

	1888.	1889.	1890.	1891.
January.....	11,269	24,986	35,038	53,205
February.....	12,162	25,800	36,886	50,073
March.....	14,706	28,075	37,600	52,949
April.	15,853	27,136	38,799	56,362
May.....	19,002	36,298	38,884	54,672
June.....	16,328	31,272	37,412	55,863
July.....	19,966	32,407	39,452	54,920
August.....	19,877	32,142	42,861	59,070
September	20,495	34,369	45,467	65,601
October.....	27,775	31,914	45,250	72,793
November.....	27,336	36,116	46,800	73,400
December.....	26,148	39,218	50,352	.....
Total ounces ..	230,917	379,733	494,801	648,908

The total yield up to last reports figure 1,789,488 ounces.

Our correspondent reports the shipments of phosphate 75-80%, from the port of Femandina, Florida, since last advice, as follows :—

		Tons.
Previously reported		44,090
Dec. 1, ss.	Royal Welsh, Newcastle	1,100
4, ss.	Oakdale, London	1,505
15, ss.	Hallamshire, Gothenburg	1,451
23, ss.	Fermore, Liverpool	1,600
31, ss.	Alarich, St. Louis du Rhone	1,844
31,	American schooner Jennie Hall, Richmond, Va	580
31, ss.	Samuel Tyzach, London	1,100
Grand total for 1891		54.270

An Australian paper publishes the following:—

"Mr. Bingay, the well known dentist, has brought to this office the lower jaw of a sheep containing four teeth, which are covered with a thick deposit in the form of a dark conglomerate, upon which there is a thin layer of gold. This jawbone was obtained from Mr. Ker, of Fremantle, who states that the sheep from which the remarkabie bone was taken was one of a mob from the Murchison district. Mr. Bingay's opinion in connection with this curiosity is that the gold became affixed to the teeth while the animal was grazing newly-grown herbage, the roots of which had come into contact with the precious metal."

Pretty steep?

Sir William Dawson, the esteemed Principal of the University of McGill, whose reputation as a Canadian geologist is world-wide, will be the subject of our next portrait sketch.

The value of the phosphate exported to the United States during the past year, as per Consular returns, was :—

Ottawa Valley	$12,600
Kingston District (351 tons)	1,346
Total value of phosphate	$14,446

The exports of mica to United States so far reported, were :—

Kingston District	27,692 lbs., or	$ 6,970.00
Ottawa Valley		23,817.17
Brockville	77,775	4,925.83
Belleville	272½	

Exports of nickel matte to United States were :

Via Prescott, of a value of	$363,000.00
" Carleton Place, of a value of	569.17
Or a total value of	$363,569.17

Exports of iron ore from Bristol mines, Pontiac County, Que., as reported by Consul-General Lay :—

March quarter	$2,930.14
December quarter	660.00
	$3,590.14

There was also a shipment of asbestos from Ottawa of a value of $250.

The exports of mineral from Belleville, other than reported above, were :—

Actinolite, (bags)	320
Gold quartz, lbs)	28,800

CORRESPONDENCE.

The Sale of Attic-Okan Iron Lands to a Belgian Syndicate.

Ottawa, January 9th, 1892.

Sir,—I have the honour to acknowledge receipt of the letter dated the 7th inst., by which you make inquiries as to the reported sale of the Attic-Okan iron range near Port Arthur.

Although I am under the impression that the real facts connected with this reported sale will fail to interest you, I take much pleasure in complying with your request.

On the occasion of the presence in Canada of engineers connected with a large banking corporation in Belgium, whose main object is to foster mining industries and railways, some of the owners of the iron range above mentioned expressed the desire that their property should be examined with a view to the working of the locations, and the construction of a railway connecting the latter with the main-line of the C. P. R. This desire having complied with, upon my own instructions, the immediate consequence was the completion of a series of agreements which will imply the execution of the programme as originally proposed by the owners, providing the thorough exploration work which would have to be proceeded with next season, in the Belgian interest, gave the satisfactory results anticipated. I may add that the lease of some of the best locations in the range to Americans actively engaged in the iron trade within the United States, very nearly caused my countrymen to abandon further consideration of the matter, as a distinct undertaking with respect to the *bona fide* working of these locations was thought to be indispensable before making any investment for railway construction. But further consideration of the subject has convinced me personally that one would not be warranted in attributing to the said Americans, who have been extremely courteous throughout all negotiations, any intention of "locking up" the property ; and, further, of their inability to carry out such intentions should they really be entertained.

A sufficient market for the ore transported over the lakes could apparently be secured in the United States ; but I look upon the scheme as one which may give Belgian iron masters and capitalists an opportunity of erecting in Canada steel works similar to those which they have established in many European countries, and more recently, in Russia. With this ultimate object in view, I have taken more than ordinary interest in the overtures and arrangements already made ; but it is only fair to my countrymen that I should conclude by making the distinct statement that, up to the present time, no one in Belgium, beyond the directors of the bank already referred to, has ever heard of the Attic-Okan iron range.

Hoping these explanations may suit your purpose, I am,

Yours truly,

Ferd. Van Bruyssel.

The Duty on Lead Ores.

Calgary, 30th Dec., 1891.

Sir,—There is no question of more pressing importance to the mineral interests of western Canada than the question of a market for lead. Your remarks in the current number of the Canadian Mining Review, in favor of raising the duty to $30 per ton, will be received with universal approval throughout the mineral districts of Canada ; but there is one point in your article to which I desire to draw your attention. You say that "the home market consumes now about 18,000 tons" of lead. I would respectfully ask you to test the accuracy of this figure and you will, I think, find that 5,000 tons, instead of 18,000, is the truth.

The imports into Canada of lead and lead manufactures amounted in 1889, to $284,350, and in 1890, to $369,864, which, at market prices, represent about 4,000 and 5,000 tons respectively.

Yours truly,

George Alexander.

[The value of the imports of manufactured lead and its products into Canada during 1890, as per official statistics, were :—

	Quantity.	Value.
Lead & manufactures of, (cwt)	101,587	$284,246
Bars, blocks and sheets (cwt).	17,363	54,166
Pipe (lbs)	70,333	3,585
Shot (lbs)	89,650	3,357
Nitrate and acetate of lead, not ground (lbs)	252,652	12,062
Manufactures of lead not otherwise provided for		15,805
		$373,221
By Products—Paints and Colours.		
Colours, dry (lbs)	511,835	12,761
" ground in oil	———	73,682
" black (lbs)	12,275	15,748
Dry, white and red lead, etc., (lbs)	10,859,672	381,959
White lead in pulp	———	250
Oxides raw (lbs)	1,381,266	13,751
Paints mixed in oil		19,891
		$518,042

—Editor.]

The History of the Dufferin Gold Mine, N.S.

Halifax, January 9, 1891.

Sir,—The account of the finding of the famous Dufferin or Salmon River lode, as given by Mr. G. F. Moncton, in your issue for December, is in some respects not quite correct. This article and the recent suit of Stewart vs. Mott, have recalled vividly the circumstances attending the early history of this mine, perhaps the most famous gold mine of the Dominion, and a synopsis of the exact facts in its history may be of interest to many of your readers.

In the early spring of 1880, Mr. Geo. W. Stuart, (who has been identified with the gold industry of Nova Scotia from its beginning), had put men to prospect in the dense forests of hard and soft wood which are found surrounding the lakes from which Salmon River is fed. Much good drift and other satisfactory indications were found, but work was temporarily suspended owing to wet weather. Shortly afterwards, Mr. Stuart told Mr. Alex. Kent Archibald, now the largest shareholder in the Dufferin Co., of the good indications he had obtained, and the two arranged to have further prospecting done later in the season. Some little time after this interview, Mr. Archibald one day heard that an Indian, "Dandy Peter" by name, had some specimens of gold quartz, and upon interviewing the Indian, ascertained that the specimens had been obtained upon the tract which he and Mr. Stuart had arranged to prospect. As the specimens the Indian had were very fine, showing coarse gold, and many persons saw them, Mr. Archibald became alive to the fact that soon there would be brisk competition, and that immediate action was necessary. Having just "blowed his bottom dollar" into another mining venture, Archibald was "strapped" as miners usually are, furthermore, his friend Stuart was away, and as good as inaccessible so far as time was of value. So he borrowed twenty dollars, and with it hired "Dandy Peter" to go with him and show him the spot where the specimens came from. Other people were watching Peter, hoping to get the desired information without paying for it, so it was necessary to be cautious in starting out.

Under cover of midnight and total darkness Archibald and Peter started off, taking with them a lantern, which they took good care not to light until well into the woods.

Peter's memory and woodcraft served them well, and long before day dawned he announced his whereabouts by saying, "Sit down now, smoke pipe ; daylight me show plenty quartz, plenty gold ;" and he kept his word.

After paying the Indian his $20 and making his boundaries for the location of a large area of ground, Archibald returned to Salmon River settlement, got a horse and wagon and started for Halifax, some ninety miles away, to secure rights from the Mines Office. Just after starting he learned that the mail coach (which had preceded him), had on board a man bound on the same errand. Now the mail coach stopped for the night at Tangier, but Archibald, after eating his supper and having a quiet smoke, slipped out of the inn, hitched up his horse and, driving all night, arrived in Halifax early in the morning and many hours ahead of Her Majesty's mail. But here he met the same difficulty as in dealing with "Dandy Peter." Stuart, who had funds, and whom Archibald felt in honour bound to associate with himself, was absent in a distant part of the province. There was no time, however, to be lost, so Archibald went to Charles F. Mott and stated the facts. Mott refused to recognize Stuart in any way, but hastened to the Mines Office with Archibald, and a large block of areas was taken out. Shortly thereafter the lode itself was found and work began, which has continued uninterruptedly ever since. As soon as the lode was found, suits were begun by other parties, claiming the ground on one pretext or another, and for nine years this valuable mining property could not show a clear title. At one time suits were so numerous and claimants so vigorous that Archibald and the other owners erected a tight board fence, sixteen feet high, enclosing their works, and openings, and had sentinels posted all around the stockade and at various points along the road to Salmon River village, a distance of five miles.

Archibald recognized his moral obligation to Stuart and conveyed a portion of his share to Stuart. Mott also promised Stuart a portion of his share if he (Stuart) would give the mine the benefit of his experience and advice. Mott, however, never kept his word, but the courts have recently decided that he must pay to Stuart the proportion promised him.

At the death of Capt. Edward Archibald, an owner, the property was sold at public auction to settle the estate, Capt. Archibald having died intestate. The sale took place March 14th, 1889, and was bid in by the former owners with the exception of Mr. C. F. Mott, who was left out in the cold. The price obtained was $141,000, but was no index to the value of the property.

This, briefly, is the history of the biggest gold mine Nova Scotia has yet produced ; after more than eleven years of continuous production, it is still at work and bids fair long to be.

"Durham."

The Spokane and Great Northern Mining Co.

Spokane, Wash., Jan. 18, 1892.

Sir,—Referring to your issue of December last, you express the hope that "The Spokane and Great Northern Mining Co. will spend money for other development than in printing certificates of stock."

I will say in this connection that the company mean business, having secured control of five free milling gold and four high grade silver properties on Boundary Creek, British Columbia. We have let a contract to extend the lower tunnel on the "None Such" mine; about three hundred feet of development has already been done on this property. In addition to this, arrangements are now being made to erect a five-stamp mill on Boundary Creek for the purpose of working the gold ore from the "None Snch" and "Mountain Chief." As the contract calls for the mill to be in operation by September 1st, you can readily see that the company is not a paper one. What we purpose doing is fully set forth in our circular "A."

The proceeds of all sales of treasury stock will be devoted to the development of the mines.

Not an officer of the company draws a salary, and all expense aside from development is reduced to the minimum. It can safely be said that inside of a year the stock of the company will approach par. I take pleasure in sending you this in order to correct an erroneous impression which might be gathered from the reading of the concluding paragraph of your mention of the company.

Very truly yours,

Arthur B. Keeler,
Vice-Pres.

A Mushroom Mineralogist.

SUDBURY, December 25th, 1891.

SIR,—In a paragraph in a late issue of the REVIEW you express a curiosity to know if Robert H. Ahn, who used to be a sort of wandering jeweller without the "h" in his name, is the same party who has recently blossomed out into a "mining expert and mineralogist" here, as the legend reads on his card. The very same man. He came to this district about two years ago, representing that he was backed by millions of capital, and with more schemes on paper, or rather on his tongue, than Col. Sellers had ever dreamt of. To test a separator of his own invention, he began to build reduction works at Nickel City, with funds supplied by some Toronto innocents and thereby hangs a tale. The works were erected on the know-nothing plan, the separator would not clean itself, much less take the mineral out; the company lost at least 50 per cent. of the money they put into the concern. His unpaid debts no one can number: and the poor workmen employed by him, after waiting in idleness all summer, had to take seventy-five cents on the dollar for their wages. In short, he has, locally, done more injury to the mining interests of the district than any other man who has ever struck the range. But he cheeks it out, and is still to be seen here now and again, as large as life, and telling a new set of plausible stories, calculated to astonish the natives if nobody else. A habitant at Whitefish gives the best description of the fellow: "Some one say to me he was good for fix de watch, but he is no good for de mining business: no head, all talk, dat's noding." Very true. Yours, etc., A. MCCHARLES.

TORONTO, 12th January, 1892.

SIR,—Your reference to a certain gentleman (?) in last REVIEW is much appreciated here. Unfortunately you were right regarding him, as I and several others know to our cost. Yours, etc., R. A.

SUDBURY, 20th January, 1892.

SIR,—Your persistent endeavor to expose the mining quackery that unfortunately buds and blossoms too prominently in young mining countries like our own, has created a very favorable impression in this neighbourhood. The party you referred to in last REVIEW deserves no pity. His schemes and chimeras have done this district much injury. More power to your elbow say we.

Yours, etc., A MINER.

LEGAL.

Stuart vs. Mott.

This case was tried in Halifax, N.S., December 3 to 5, before Mr. Justice Townshend, without a jury. The action was for a one-eighth interest in the defendant's share of dividend and sale profits of the famous Salmon River gold mine, said one-eighth amounting to $12,000.

A similar suit was instituted in 1883-84, and won in the lower courts, but lost, on appeal to Ottawa, under the provisions of the statute of frauds, no written contract having been made.

In the present suit the plaintiff, George W. Stuart, relied upon the defendant's (Chas. F. Mott's) own admissions made in the first trial, and adopted defendant's view as to the contract made. This, as sworn to by Mott in the first trial, was: "I promised Stuart the eighth part of the proceeds of what I got from my share of the mine when *it was sold*, whatever it (the proceeds) was from the beginning. I told him he was not entitled to anything until after the mine was sold-"

The mine was sold on the 14th of March, 1889, to wind up the estate of Capt. Edward Archibald (who died intestate) and brought the sum of $141,000.

Although Mott signed the agreement for the public sale, yet after the sale he refused to sign the transfer, and it was not until the spring of 1890 that he accepted his share of the money, plus a bonus which he demanded, and then signed the documents.

The conditions of the agreement, as testified to by Mott, now being completed, and a sufficiently reasonable time having elapsed, the plaintiff, Stuart, brought the present suit, and judgment was given in his favor. The following is the full text of the judgment:—

I have considerable difficulty in coming to a conclusion in this case, due chiefly to the peculiar relation of the parties to the evidence on which plaintiff attempts to sustain his position.

The first question I am called upon to decide is one of fact. Did the parties make the agreement set out in the statement of claim?

In proof of this agreement, plaintiff puts in evidence a portion of defendant's sworn testimony in a previous suit between them, in which defendant says: "I promised Stuart the eighth of the proceeds of what I got out of my share of the mine when it was sold, the eighth of whatever it was from the beginning." He adds: "There was no consideration for my promise to Stuart. He was not to do anything or render any service in return for it." At another place he says: "My promise to him was a free gift. He paid me nothing for it, and I did not ask him anything for it." The plaintiff has sworn the consideration of the agreement to be: (1) The putting into the mines of certain machinery at very much less than its value; (2) The abandonment of a lucrative position in Mexico at defendant's express request; (3) The giving of his time and skill in management and working of the mines, and in defending the title of the property, at that date in litigation; (4) and the lending to defendant of certain money to assist in carrying on operations in the mine, and says that, in pursuance thereof he carried out all his part of the agreement. This agreement, he asserts, was definitely concluded on the 5th day of May, 1881. The defendant denies specifically the fact that any one of these alleged considerations had to do with his promise.

The peculiarity of the plaintiff's position is this, that in a previous suit he alleged, and swore, that in consideration of the above the defendant had agreed to transfer to him one-eighth of his interest in the mine when the then pending litigation was ended. He failed in that suit because the contract was not in writing, and therefore no action could be brought upon it by reason of the statute of frauds. The mine has since been sold, and he now contends that he is entitled to adopt the defendant's version of the contract, even though not in the terms as he understood it. The defendant contends that if his version of the contract is to be taken as true, it must be taken as a whole; and if so, it is *nullum factum*, and plaintiff cannot succeed. I think, however, it is my duty to consider the whole evidence, and I derive from it the real contract between the parties; the fact that plaintiff misunderstood one term of the agreement is not to preclude him from recovery, provided I am satisfied that a proposition was made to him, valid in law, which he accepted although he misapprehended the effect of it when made. Having regard to the whole evidence, I have come to the conclusion that defendant made the promise, as sworn to himself, for the considerations, or some of them, set up by the plaintiff, and they are sufficient in law to uphold it. I do not feel it necessary to explain all the reasons which led me to this conclusion, but I may say that I have given every weight to the arguments pressed by Mr. Borden, viz., that there is not evidence to show that the parties were as one in respect to what the agreement was. I cannot adopt it, as the same might be said of every transaction where the parties differ as to its terms. It then becomes a subject for judicial determination to decide what the true terms of the agreement were. As to the question of estoppel, I think it clear from all the pleadings and evidence before me that there is nothing to prevent the plaintiff from recovery because of the former litigation, if in other respects his claim is well founded.

The present action is for an alleged right not then in existence and which, therefore, could not have been the subject of litigation and consequent estoppel. No judgment, as I understand, has ever passed on this particular claim.

The statute of frauds, set up as a defence, presents a question of greater difficulty, but after consideration I have come to the conclusion that the contract on which plaintiff now seeks to recover, not being any interest in lands or mining rights, does not come within this statute, and my judgment is therefore in favor of the plaintiff. The terms of the order and further directions to be settled on motion for that purpose.

S. J. and Sophronia Ritchie vs. The Canadian Copper Co.

Answers were filed on 10th ulto., in the suit brought recently by Samuel J. Ritchie for the dissolution of the Anglo-American Iron Company and the Canadian Copper Company. In the Anglo-American Iron Company's answer the incorporation is admitted. It says that after organization, the Company was re-organized by a special act of the Dominion Parliament and was thereby given all rights and privileges awarded corporations in Canada. It is denied that Mr. Ritchie is the owner of any of the capital stock in his own right, but it is admitted that Mrs. Ritchie is the registered owner of 3,004 shares which were pledged to secure an indebtedness equal to or greater than the market value of the certificates. The answer further states that on October 8, 1891, James B. and George W. McMullen brought a suit in the United States Court against Samuel J. Ritchie and others to collect a judgment of $265,307, and that Thomas W. Cornell and others were made parties in the case. It also alleges that the company was organized chiefly by Samuel J. Ritchie, and that, with others, he acquired a three-quarters undivided interest in 80,000 acres of land in the wilds of Ontario, William Coe, who has since died, being the owner of the remaining one-quarter interest. It is further stated that on the conveyance of the three-fourths interest by Mr. Ritchie to the corporation he was given stock to the amount of $1,500,000. Soon after this, contention and litigation sprang up between Messrs. Ritchie and Coe, which wholly prevented the company, it is alleged, from using the lands. It is also alleged, that from the date of the organization of the corporation up to the present time Mr. Ritchie has had chief control of the three-quarters interest and he is still a director and vice-president of the company. It is charged that the proceedings to dissolve the corporation were instituted to injure the stock pledged as security and that because of the property being tied up by the litigation, between Messrs. Coe and Ritchie, the company was unable to make any earnings. It is also stated that the company at one time took steps to adjust the difference between Messrs. Ritchie and Coe so that the timber and lumber on the land could be utilized, but that a letter was received from Mr. Ritchie in which he said he held a claim against the estate of Mr. Coe for $500.000 that must firsr be settled.

The answer to the suit against the Canadian Copper Company is to the same effect, in regard to the pledging of securities and the McMullen suit, as the answer in the Anglo-American Iron Company case. It also states that the defendant believes the suit to have been brought for the purpose of injuring the stock and to prevent the McMullens from collecting on their judgment. It further alleges that the company was organized by Mr. Ritchie, who for the first few years assumed practical control of it. At first the company's property consisted of wild, undeveloped copper and nickel mining lands in Canada. The answer recites that since Mr. Ritchie ceased to dominate in the company, three large mines have been developed. They were equipped with machinery; fifty houses have been built for workmen, two smelters have been erected for the reduction of ores, and a Bessemer plant for the refining of nickel and alloys of nickel and copper is nearly completed, at Brooklyn, a suburb of Cleveland. The total construction account to the present date has been $1 200,000. The answer concludes by saying that the earnings of the company have been over 6 per cent and that the suit was brought by Mr. Ritchie for the purpose of depressing the stock.

The Canadian Copper Company's Suits—Mr. Stevenson Burke, the President, Talks of the Trouble.

Mr. Stevenson Burke, President of the Canadian Copper Co., on being interviewed with reference to the suits of S. J. Ritchie and Sophronia J. Ritchie, to dissolve the Anglo-American Iron Co. and the Canadian Copper Co., said:—

"There is as much chance of a dissolution of the Anglo-American Iron Company and the Canadian Copper Company as there is of Samuel J. Ritchie being struck by lightning in January. It is the veriest nonsense. He has an idea that he can coerce us into paying money for thin air. Many years ago, as the good book tells us, there was a wise judge before whom two women claimed to be the mother of a child. The judge, after hearing both sides, took a novel way of deciding the case. He ordered the child cut in two and half given to each woman. One woman assented but the other said: 'No no, let the other woman have it,' whereupon the judge decided that she was the real mother because of the motherly affection she showed. It is precisely the same with Samuel J. Ritchie. He does not own a dollar's worth of stock in either one of the corporations, for if he did he would not take this means of depreciating the stock. The whole thing is easily explained, however. Saturday I filed three answers in garnishee proceedings begun against ex-Senator Payne, Thomas W. Cornell, and myself to recover certain securities which we held and which, it was alleged, belonged to Ritchie. The proceedings were begun by the Messrs. McMullen, who recovered a judgment some time ago for $265,000 or thereabouts. These answers show the ingratitude of Ritchie. I set up in my answer that Ritchie has owed me $150,000 for over seven years. On this amount he has not been able to pay me any interest, even for five years. I borrowed the money for him, and every six months I am compelled to pay over $5,000 interest for its use, or for the use which Ritchie has made of it. Besides this he owes me $80,000 borrowed money which he has been unable to pay. This doesn't look as if I am trying to press him. As security for these loans I hold $105,000 in Canadian Copper Company stock, which is worth par value, and $400,000 in Anglo-American Iron Mining stock, which is worth between $30,000 and $40,000. If Ritchie can get anybody to take these securities and pay his debt to me I will make him a present of $10,000 and agree to the dissolution of the two corporations. He owes Senator Payne about $525,000, and the Senator has been as indulgent with him as I have. This money was obtained long ago. Mr. Payne holds about $300,000 worth of Canadian Copper Company stock as security. He agreed to redeem it in either thirty or sixty days. I, of course am not speaking for Senator Payne, but I will venture to say that the Senator will pay him $10,000 if he will bring a man who will take the stock and pay the debt, and he will also agree to the dissolution of the corporation. Thomas W. Cornell is the wealthiest citizen in Summit county, and he has, in years past, been a great friend of Ritchie's. In his answer to the garnishee proceedings, it is set forth that Ritchie owes him $200,000. It is secured by $80,000 in Canadian Copper Company stock and between $200,000 and $300,000 in Anglo-American Iron Mining stock. I will also venture to say that Mr. Cornell will pay $10,000 to the man who will redeem the stock by paying the debt, and that he will also agree to the dissolution of the corporation. This is the stock Mr. Ritchie claims to own. I do not consider, however, that he owns a cent's worth, for he is bankrupt. We have carried him for six or seven years, and he has not at any time owed us less than $500,000, and to-day he is indebted to us for $900,000. His sole purpose in bringing these suits is to injure the securities we hold for his debts. He has boasted that he would smash the concerns if we did not do as he wished. He wants us to consolidate the Copper Company and the Mining Company with the Central Ontario Railroad, of which he is president. That would be impossible, however, and we wouldn't do so if we could. Ritchie speaks, as I see, of the earnings of the corporation being eaten up by the enormous salaries paid the officers. I, as president, never received a farthing for my services, and I don't know of an officer who is prominently identified with the companies who has. I also hold $225,000 in stock of the Central Ontario Railroad for money Ritchie owes me, The road hasn't paid the interest on the money it owes, let alone dividends. Probably he wants to dissolve that corporation. The Canadian Copper Company has made money enough recently to pay a dividend of 10 per cent., but we have been using the money in improvements. We have spent $1,200,000 in construction. Our copper works in South Brooklyn, just completed, cost $100,000."

Second Annual General Meeting of the General Mining Association of the Province of Quebec. Report of Privy Council on Quebec Mining Act, etc.

The Second Annual General Meeting of the General Mining Association of the Province of Quebec was held in the new club room, Windsor Hotel, Montreal, on Wednesday, 13th January, commencing at eleven in the forenoon. There was a large attendance. Among those present we noticed: L. A. Klein, American Asbestos Co., Black Lake; C. Circkel, Templeton Asbestos Co., Templeton; D. A. Brown, Bell's Asbestos Co., Boston; S. P. Franchot, Buckingham; Col. Lucke, Beaver Asbestos Co., Sherbrooke; O. M. Harris, Canadian Phosphate Co., Montreal; John J. Penhale, United Asbestos Co., Black Lake; A. S. Johnson, Johnson's Asbestos Co., Thetford; Hector McRae, Electric Mining Co., Ottawa; George R. Smith, Macgregor Lake Phosphate Co., Montreal; F. Hilton-Green, Phosphate of Lime Co., Montreal; R. T. Hopper, Anglo-Canadian Asbestos Co.; Dr. R. W. Ells, and E. D. Ingall, Geological Survey of Canada, Ottawa; Prof. B. J. Harrington, Prof. W. C. Carlyle and Sir William Dawson, McGill University; H. A. Budden, Intercolonial Coal Co., Montreal; H. S. Poole, F.G.S., Acadia Coal Co., Stellarton, N.S.; J. T. Donald, M.A., Wm. Sclater and Theo. Doucet, M.P., Montreal; W. A. Allan, Little Rapids Mine, Ottawa; W. T. Gibbs, Buckingham; Capt. R. C. Adams, Anglo-Canadian Phosphate Co., Montreal; A. W. Stevenson, Montreal, and B. T. A. Bell, Ottawa. Hon. George Irvine, President of the Association, in the chair.

The Secretary having read the minutes of previous meetings, the following resolutions were adopted:

(1) Moved by Mr. John Penhale, seconded by Mr. D. A. Brown, that the Council be authorized to publish for distribution among the members a volume of the Transactions of the Association during the year 1891.

(2) Mr. D. A. Brown, moved, seconded by Col. Lucke, that the President, Mr. R. Prefontaine, Q.C., M.P., and Mr. Wm. White, Q.C., Sherbrooke, be a standing committee during the coming year to deal with all questions of legislation affecting the welfare of the mining industries of the province.

(3) Moved by Mr. S. P. Franchot, seconded by Mr. Wm. Sclater, that a sum of fifty dollars be donated by the Association to the Asbestos Club.

The Secretary then read the following correspondence with reference to the petition to disallow

The Quebec Mining Act.

DEPARTEMENT DU PROCUREUR GENERAL,
Quebec, 11th July, 1891.

The Honourable
The Minister of Justice,
Ottawa, Ont.

SIR,—I am directed by the Honourable the Attorney-General to acknowledge the receipt of your letter of the 8th July inst., enclosing for his information copy of a petition addressed to His Excellency the Governor General, having reference to an Act passed by this Legislature at its last session, entitled "An Act to amend and consolidate the Mining Law," and in which you state that you would be glad to give all possible consideration to any observations which the Attorney General may think proper to make respecting the said petition.

In answer the Attorney General requests you to kindly grant him a delay until the 31st instant within which to fyle an answer to the said petition, as the matter is an important one, and he will unavoidably be absent until the 18th instant.

I have the honour to be, Sir,
Your obedient servant,
(Signed), L. J. CANNON,
Assistant Attorney General.

DEPARTEMENT DU PROCUREUR GENERAL,
Quebec, 12th August, 1891.

To the Honourable
The Minister of Justice, Ottawa.

SIR,—I am directed by the Honourable the Attorney General to send you for your consideration a memorandum having reference to a petition addressed to His Excellency the Governor General relating to an Act passed by the Legislature of Quebec, entitled "An Act to amend and consolidate the Mining Law."

I have the honour to be, Sir,
Your obedient servant,
(Signed), CHARLES LANCTOT,
Law Officer.

DEPARTEMENT DU PROCUREUR GENERAL,
Quebec.

To His Excellency the Right Honourable Sir Frederick Arthur Stanley, Baron Stanley of Preston, Etc., Etc., Etc., Governor General of the Dominion of Canada, in Council, Ottawa.

The Attorney General of the Province of Quebec, in answer to the petition of A. Morrison and others, proprietors of mining lands, and persons interested in mines in the Province of Quebec, praying that Your Excellency will be pleased to disallow the Act passed by the Legislature of the Province of Quebec, at the session of 1890, 54 Vict., ch. 15, entitled the Quebec Mining Law, humbly represents:

The petitioners, in support of their said petition, allege several reasons, which may be briefly stated as follows:

1st. The Quebec Mining Law of 1890 interferes with private rights unjustly, and confiscates private property, first by repealing Article 1425 of the Revised Statutes of the Province of Quebec and replacing it by Sub-section 2 of Section 1 of the said Act, which takes away from persons who have obtained from the Crown, previous to the 1st of July, 1890, lots of land for agricultural purposes without reservation by the Government of the ownership of mines existing on their lands, which mines, according to the common law of the Province, formed part of the land of said landed proprietors.

2nd. By taking away from the purchasers of public lands patented since 1880, and of public lands upon which phosphate mines have been discovered patented since the 7th of March, 1878, the right of acquiring mines existing on their lands, on the condition mentioned in articles 1428 and 1429 R.S.P.Q., that is to say, by paying to the Commissioner of Crown Lands the difference between the price of agricultural lands and that of mines.

3rd. The law, which they ask to be disallowed, is contrary to the general interest of Canada and the trade policy of the Dominion, inasmuch as it imposes a tax or duty on an important industry.

4th. This law is ultra vires and unconstitutional.

The Attorney General of the Province of Quebec contends that these objections are unfounded, and cannot justify the disallowance of the said Act.

I.

The pretension that the repeal of Article 1425 of the Revised Statutes of the Province of Quebec takes away from the owners of the surface, whose titles are anterior to the 24th July, 1880, the ownership of mines situated on their lands is totally erroneous, inasmuch as these persons never were owners of the mineral estates (tréfonds minéral) which might be found under the surface of their lands, as the ownership of mines never was in the Province of Quebec an accessory of the ownership of the surface. According to the old French law, mines constituted a property distinctly from the soil which covered them, and this property belonged to the Crown, and did not become private property except by an express Act of the Sovereign.

Louis XI., Avril 1483.—Recueil des anciennes lois Francaises, vol. X., p. 911; id. tome XI., p. 97; id. tome XI., p. 666; id. tome XII., p. 771; id. tome XII., p. 196.

Henri II., Septembre 1548.—Id. tome XIII., p. 57; id. tome XII., p. 290. Francois II. en 1560.—Id. tome XIV., p. 41.

En 1677, 1700 et 1704,—Id. tome XIX., p. 175, et tome XX., pp. 428 et 443. Louis XV., 1705.—Id. tome XX., p. 467.

Louis XV., 1716.—Id. tome XXI., p. 79.

Louis XV., 1744.—Id. tome XXII., p. 166.

Ordonnances du 30 Mai, 1413, du 3 Novembre, 1416, du 1er Julliet, 1437, du 21 Mai, 1455, de Decembre 1461, du 10 Mai, 1463, du 19 Aout, 1467, de Septembre, 1471, d'Aout, 1483, de Novembre, 1483, de Fevrier, 1483, de Janvier, 1488, de Juin, 1498, de Fevrier 1506, et de Juillet, 1514.

Edits et ordonnances.—Vol. 1er p. 5; vol. 1er p. 45.

Edit, Juillet. 1705.

Edit. 17 Oct., 1520.

Choppin—Tome XI. du Domaine de la Couronne, titre XI. ch. 6, p. 14. Bosquet—Dictionnaire des droits domantaux, vbo. Domaine de la Couronne, vbo. Mines et Minières. Guyot—Repertoire, vbo. mines. Merlin—Rep. vbo. mines, ch. 4. Ferriere—2 vol. grand commentaire de la Contume du Paris, art. 187, ch. 10. Code Civil B.C., art. 414. Dalloz—Propriete des mines, tome 1er p. 34, et pp. 266, 306, 374, 413, 452, 455, 401, 612. Locré—Législation de la France ou Commentaire des Codes Francais, tome IX., p. 107. Dalloz, ainé—Repertoire de la législation (tome XXXI) vbo. mines et minières. Locré—Législation des mines, p. 379 et p. 399.

The right of ownership in mines, which belonged to the Kings of France, passed at the cession to the British Crown. Such was the holding of the Court of Queen's Bench in a judgment rendered on the 7th of December, 1883, in the case of Regina vs. de Léry et al. The judgment of the Superior Court is reported in IX. Law Reports, p. 225, and that of the Court of Queen's Bench in VI. Legal News, p. 402. The heading of the Report reads as follows: "By the old law of France, which is in force in Canada, the right to minerals did not pass by a grant of lands to the grantee, without special words, but remained in the Sovereign. The King of England, at the cession, succeeded to this right. The Sovereign could grant the right to the minerals to whomsoever he pleased, and, in such case, the owners of the soil had no right except to an indemnity for any damages they might suffer by the mining operations."

The British North American Act, Sec. 9, and the Civil Code of Lower Canada re-enact, on this subject, the principles of the old law. Article 414 of our Civil Code lays down the general principles that "ownership of the soil carries with it ownership of what is above and what is below it." But, at the same time, the third paragraph of this article makes an important restriction to the application of the above principle in the following terms "The proprietor may make upon the soil any plantations or buildings he thinks proper. . . . He may make below it any buildings or excavations he thinks proper, and draw from such excavations any products they may yield, saving the modifications resulting from the laws and regulations *relating to mines*, and the laws and regulations of police;" that is to say, if allowed to give more precision to the reference which is here made by the legislator to certain special regulations, saving the application of the old French ordinances and of the principles of the French law, which declare that mines belong to the Crown.

The above is sufficient to show the falsity of the pretension of the petitioners that mines situated on lands patented previous to 1880, without reservation by the government of the rights of the mines, belong to the surface owners.

Consequently, it cannot be said that the Mining Act of 1890 deprives them of a right of ownership, which they never possessed.

2nd. The petitioners also pretend that the repeal of articles 1428 and 1429 R. S. P. Q., which allow purchasers of lands mentioned in these articles to buy the mines situated on said lands, by paying to the Crown the difference between the price of agricultural lands and the price of mines, constitutes a confiscation of private property. This pretension is as unfounded as the previous one.

The mineral estate (tréfonds minéral) belonging to the Sovereign, the Legislature, in the Mining Act of 1880, indicated the mode of acquiring such mines and causing them to become the property of the owners of the surface. All of these owners, who thought proper to take advantage of this clause of the law, became absolute owners of the mines on their lands, and the act of 1890 does not in any way affect them. On the other hand, such surface owners, who did not take advantage of this exceptional privilege granted them by the law of 1880, did not become owners of the mines which might be situated on their lands, and the Legislature, by changing the mode of acquiring such mines, did not confiscate anything belonging to them. Parliament is no more bound than a private individual to give perpetual existence to an offer which has not been accepted during a certain number of years.

It is also worthy of remark that the Mining Act of 1890 when fixing in articles 1463 and following the price of mines, only exercised the powers which belong to the Lieutenant-Governor in Council, under the article 1434 R. S. P. Q., and that under the previous law, the owners of the surface mentioned in said articles 1428 and 1429, could have been forced in order to become proprietors of the mines on their lands, to pay a much larger sum than the price required by the law of 1890.

Another objection to be disposed of, under the head of: 1st. The assertion by the petitioners that articles 1455-1512 inclusively, of the Mining Act of 1890 interfere with private rights and despoil private individuals of their property. This is utterly false. These articles despoil nobody and deprive no man of his property, since they are dealing exclusively with mines which have not yet become private properties.

Moreover, the mode of exploration of the soil and of working mines, laid down by these articles, existed in the statute of 1880 and in articles 1439 and following R. S. P. Q.

II.

The petitioners bitterly complain of the imposition of a tax or royalty of 3 per cent. on the mercantile value of the products of all mines and minerals enumerated in section 1426, and declare such tax unconstitutional and ultra vires.

The imposition of a tax or royalty on the products of mines cannot be a cause of disavowal of the law which imposes such tax, as the power of imposing a tax of this nature is of the competence and within the jurisdiction of the Quebec Legislature, which alone should judge of the opportunity of imposing it, and it is not because such a tax, at a certain standpoint, affects the commerce of the country that the law which decrees it should be disallowed.

Disavowal for this cause would render necessary the disavowal of almost all the laws under which provincial taxes are imposed. Liquor licenses, timber licenses, auctioneer licenses, the law imposing a direct tax on commercial corporations, and many other of our local statutes doubtless, have a certain restrictive effect on trade and commerce. However, nobody dreamt up to this of asking the disavowal of these laws on such a ground.

It must also be remarked that the Mining Act of 1890 makes no innovation when it imposes this tax or royalty. The old French law gave the King the right to levy a royalty of ten per cent. on the products of the mines.

Regina vs. DeLéry *et al*—9 Legal News.
Law Reports, p. 125 and following.

And Article 435 R. S. P. Q., which re-enacted the Mining Act of 1880, gave the Lieutenant-Governor in Council the power to claim at any time the royalty due to the Crown upon any land already sold, conceded, or otherwise alienated, or which might be hereafter sold.

III.

The last argument of the petitioners for disavowal is that the Mining Act of 1890 is ultra vires and unconstitutional. In what manner this act is ultra vires of the Quebec Legislature, and unconstitutional, the petitioners do not see fit to state.

However, nothing can be more self-evident than the constitutionality of this law. The British North American Act specifically gives to the provinces the ownership of mines, and Section 92 of the same act gives the legislatures of the provinces exclusive power to make laws concerning them.

To sum up the question to Your Excelleucy, the undersigned humbly submit that the Quebec Mining Law, 54 Vict., ch. 15, which was duly assented to on the 30th December, 1890, is constitutional, has not a retroactive effect, does not interfere with private rights unjustly, nor confiscate private property, nor is it contrary to the policy of the Dominion or injurious to a large and increasing industry, but that it merely affirms the principles which were always admitted in the Province of Quebec, imposes a tax or royalty evidently within the powers of the Legislature, and in no way violates the constitution.

Wherefore, the undersigned humbly prays that the petition of A. Morrison and others, praying for the disavowal of the Quebec Mining Law, 54 Vic. chap. 15, be dismissed.

(Signed), J. E. ROBIDEAUX,
Attorney-General.

QUEBEC, 31st July, 1891.

QUEBEC, 9th November, 1891.

The Honourable
The Minister of Justice,
Ottawa.

SIR,—I am directed by the Honourable the Attorney-General to inquire from you if any decision has been arrived at in the matter of the petition of A. Morrison and others, proprietors of mining lands, and persons interested in mines in the Province of Quebec, praying that His Excellency the Governor General be pleased to disallow the Act passed by the Legislature of the Province of Quebec, at the session of 1890, 54 Victoria chapter 15, being the "Quebec Mining Law," and, if not, when such a decision may be expected, and if the interested parties are to be heard before the rendering of such a decision.

I have the honour to be, Sir,
Your obedient servant,
(Signed), L. J. CANNON,
Assistant Attorney-General.

DEPARTMENT OF JUSTICE,
Ottawa, 2nd December, 1891.

L. J. Cannon, Esq.
Depu'y-Attorney-General, Quebec.

SIR,—Adverting to my letter to you of the 27th ultimo on the subject of the Petition asking for the disallowance of the Quebec Mining law of 1890, I beg to state that in considering the arguments of the Honourable the Attorney-General and the petitioners, it appears to the Minister of Justice that one contention of the petitioners deserves further consideration. It may be summarized as follows:

Whatever may be the law with respect to grants issued by the French Crown, before the cession in which the mines were not specifiically granted, the substituted article 1425 does not correctly state the law with respect to the patents made by the British Crown subsequent to the cession in which the mines were not expressly reserved. Such grants, it is contended, would, under the English prerogative law which governs them, include the mines and minerals other then gold and silver without their being expressly mentioned. In fact, it is contended that the whole jurisprudence of the country went to establish that where lands were granted without reserve of minerals, all baser metals became the property of the grantee.

Reading the substituted Article 1425 in connection with the definition of the words "private lands" given in the interpretation clause of the Act, it would cover all lands whether granted previous to 1880 or not, in the grant of which no mention is made of mines and minerals. It, therefore, virtually amounts to a confiscation of all mines or mining rights in such lands.

The Minister of Justice will be very pleased to receive any observations which the Honourable the Attorney-General may see fit to offer with respect to the above points.

As the time within which the Act must be reported upon will expire in a few days, I trust that I may be informed at once whether any observations on these points are to be made.

I have the honour to be, Sir,
Your obedient servant,
(Signed), ROBT. SEDGEWICK,
D.M.J.

QUEBEC, 12th December, 1891.

To the Honorable
The Minister of Justice,
Ottawa, Ont.

SIR,—I duly received the letter of Mr. Sedgwick, Deputy Minister of Justice, dated the second December instant, in which he states that, in the matter of Petitioners asking for the disavowal of the Quebec Mining Law of 1890, in considering the arguments of the Petitioners and my arguments it occurred to you that one contention of the Petitioners deserved further consideration, which said contention Mr. Sedgewick summarises as follows:—

"Whatever may be the law with respect to grants issued by the French Crown before the cession, in which the mines were not specifically granted, the substituted article 1425 does not correctly state the law with respect to patents made by the British Crown subsequent to the cession in which the mines were not expressly reserved. Such grants, it is contended, would, under the English prerogative law which governs them, include the minerals other than gold and silver without their being expressly mentioned. In fact, it is contended that the whole jurisprudence of the country went to establish that where lands were granted without a reserve of minerals, all the baser metals became the property of the grantee.

"Reading the substituted article 1425 in connection with the definition of the words 'private lands' given in the interpretation clause of the Act, it would cover all lands whether granted previous to 1880 or not, in the grant of which no mention is made of mines and minerals. It therefore virtually amounts to a confiscation of all mines or mining rights in such lands."

On this point I now beg to offer the following additional remarks:

At page 2 and following of my letter of the 31st July last, I claim to have established that "according to the old French law mines constituted a property distinct from the soil which covered them, and these properties belonged to the Crown, and did not become private property except by an express act of the Sovereign," and that the right of ownership in mines which belonged to the King of France passed, at the cession, to the British Crown. (*Vide* Treaty of Paris, 1763, Section IV., pages 61 and 62 Houston's Constitutional Documents of Canada.)

To avoid the consequences resulting from the application of this rule, the petitioners for disavowal now contend that, since the cession, mines in this Province are no longer subject to the old French law, but are governed by the public law of England relating to prerogatives of the Crown, which confers to the subject in whose lands they are discovered, all mines excepting mines of gold and silver, to which by his prerogative the King is entitled, and that the jurisprudence of this Province is unanimous on this point.

This contention of the Petitioners for disavowal, I hold to be erroneous for the following reasons:

The mineral estate (tréfonds) in a land is by nature an immovable property (2, Aubrey vs. R., page 11), and, as such continued, after the cession of this country to England, to be regulated by the laws in force in this Province under the French domination, as modified by our statutes, which laws were preserved to us by the capitulation, treaties and our different constitutional acts.

The Quebec Act, 1774, Sec. VIII., Houston, page 93.

The Constitutional Act, 1791, Sec. XXXIII., Houston, page 124.

The Union Act, 1840, Sec. XLVI., Houston, page 168.

The Confederation of 1867, Sec. 129, Houston, page 212.

The jurisprudence of this Province is in perfect accord with the doctrine I have just laid down, as can be ascertained by the holding in the case of Regina vs. de Léry et al., already cited in my letter of the 31st July, 1891, 6 Legal News, page 4021: "*1st.* By the old law of France, which is in force in Canada, the right to minerals did not pass by a grant of lands to the grantee without special words, but remained in the Sovereign. *2nd.* The King of England at the cession succeeded to this right. *3rd.* The Sovereign could grant the right to minerals to whomsoever he pleased, and in such case the owners of the soil had no right except to an indemnity for any damages they might suffer by the mining operations."

The fact that the right to mines is a prerogative of the Crown does not prevent the old French Civil Law, as modified by our statutes, to apply to mines in our Province. The prerogatives of the Crown are of two kinds: direct prerogatives, and incidental or minor prerogatives. (Bowyer, Constitution Law, page 134.)

The right to mines is one of the minor prerogatives.

It is quite true that the direct prerogatives of the Crown are governed by the public law of England, but the same does not apply to the minor prerogatives of the Crown in this Province; they are governed by our Civil Law, which is the old French Civil Law, as modified by our statutes.

Chitty, on prerogatives, page 25, expresses himself as follows:—

"But in countries which, though dependent on the British Crown, have different and local laws for their internal government, as for instance the plantations or colonies, the minor prerogatives and interests of the Crown must be regulated and governed by the peculiar and established law of the place." (Idem, pages 29-30-31.)

Our courts have several times applied this principle.

Chief Justice Reid, in rendering judgment on the 30th July, 1828, in a case of the Attorney-General pro Rege, Appellant, and Jane Black, Respondent, expressed himself as follows in the holding of the case:—

"Where the greater rights and prerogatives of the Crown come in question, recourse must be had to the public law of the Empire, as that alone by which they can be determined; but where its minor prerogatives and interests are in question they must be regulated by the established law of the place where the demand is made."

In this case Chief Justice Reid gives the following extract from Chitty:—

"That in the colonies and plantations, the minor prerogatives and interests of the Crown must be regulated and governed by the particular and established law of the place where the demand is made," and accordingly, where peculiar laws and process exist, as in Guernsey and Jersey, the King himself, in seeking to recover his own debts therein, must resort to such laws for redress." (Stuart's Reports, pages 324, 325, 326.)

Later on, on the 22nd December, 1874, Chief Justice Dorion, on rendering the judgment of the Court of Appeals in the case of Dame Georgiana H. Monk vs. qualité, Appellant, and the Honourable G. Ouimet, Attorney-General pro Regina, Respondent, expressed himself as follows:—

"When this colony passed under the dominion of the Crown of England, the maintenance of the civil laws then in existence was guaranteed by treaty. These laws, as altered by competent authorities, are still in force, and are as binding on the Crown as they are upon any of its subjects, except in cases where the higher prerogatives, which form part of the public law throughout the whole Empire, are affected. The right to be paid in preference to other creditors of a common debtor does not form part of the higher prerogatives of the Crown, which are part of the public law, but belong to what are termed the minor prerogatives, those which are not essential to the supremacy of the Crown, and which are controlled by the *private or municipal law of that part of the Empire where they are claimed.*

"Vide also Chitty on Prerogatives, 25, 29, 31; Chambers' Colonial Opinions, 88, and Attorney-General and Black; Stuart's Reports, 324, where this rule has been followed."

I respectfully submit that the above authorities establish beyond doubt that in our Province mines are regulated by the old French Civil Law, as modified by our statutes.

The contention of the Petitioners for the disavowal, that our courts have invariably held that the ownership of mines on lands granted before 1880, without reserve of mines thereon by the Crown, belong to the surface owners, is absolutely unfounded. The Petitioners do not cite a solitary decision in support of this alleged jurisprudence, for the obvious reason that no such decision exists. The few reported decisions on this question amongst which that of Regina vs. de Léry, already cited, absolutely lay down a doctrine contrary to that claimed by the Petitioners.

Wherefore, I respectfully persist in praying that the Petition of A. Morrison and others, for the disavowal of the Quebec Mining Act, 54 Vict., Chap. 15, be dismissed.

I have the honor to be, Sir,
Your obedient servant,
(Sgd.) J. E. ROBIDEAUX,
Attorney-General.

OTTAWA, 16TH DECEMBER, 1891.

The Honourable
J. E. Robideaux,
Attorney General.

MY DEAR ATTORNEY-GENERAL,—I am much obliged for your letter of the 12th instant, having reference to the petition for disallowance of the Quebec Mining Law of 1890.

Will you permit me to say that I am still far from being convinced that Crown grants in your Province, since the cession, have the limited effect which you claim they have, and I am likewise somewhat in doubt as to the limited character of Crown grants issued prior to the cession. The Statute under consideration makes the statement that "*it is admitted that mines, whether upon private or public lands, belong to the Crown.*" If the legislation in question were really based upon an admission, it ought to appear that the person making the admission had authority to make it from those who would be affected by it. It seems clear, however, both from the Statute itself and from the correspondence, that your Legislature intended to legislate in respect only to mines which, as a matter of fact, belonged to the Crown. I may be excused for suggesting that all difficulty might be removed by an amendment making it clear that the Act only applied to mines and minerals which belong to the Crown, without making any specific declaration that this includes all minerals in lands granted by the Crown although not specifically reserved. In that case the legal questions which have been raised, and in respect of which there may, I think, be considerable doubt, would be left for determination by the courts. Such an amendment it appears to me, while in no wise impairing the just rights of the Province, would remove any objection to the Act on the ground of its being a confiscation of existing private rights as claimed by the petitioners. An assurance from you that your Government, at the next session of your Legislature, would promote an amendment to the effect suggested, would materially aid me in making my report to His Excellency in Council on the subject of the Quebec legislation of last Session.

Believe me,
My dear Attorney-General,
Faithfully yours,
(Sgd.) J. S. D. THOMPSON.

QUEBEC, 18th December, 1891.

To the Honourable
Sir J. S. D. Thompson,
Minister of Justice,
Ottawa.

SIR,—I have the honour to acknowledge the receipt of your letter of the 16th instant, to the Honourable the

Attorney-General, in the matter of the disavowal of the Quebec Mining Law of 1890.

I have the honour to be, Sir,
Your obedient servant,
(Sgd.) L. J. CANNON,
Assistant Attorney-General.

OTTAWA, 22nd December, 1891.

The Honourable
T. Chase Casgrain,
Attorney-General,
Quebec.

MY DEAR ATTORNEY-GENERAL,—I beg to enclose you copies of certain papers and correspondence having reference to the disallowance of the Quebec Mining Act of last session of your Legislature. You will observe that my last letter to your predecessor was written on or about the day when he ceased to be Attorney-General, and I have not received any reply from him. I send the whole correspondence to you in the hope that I may be able to obtain from you at an early day an assurance that the Act will be amended at the next sitting of your Legislature in the manner I have suggested.

Yours faithfully,
(Sgd.) J. S. D. THOMPSON.

CABINET DU PROCUREUR GENERAL,
PROVINCE DE QUEBEC,
Quebec, December 23rd, 1891.

The Honourable
Sir J. S. D. Thompson, K.C.M.G.,
Minister of Justice, Ottawa.

DEAR SIR JOHN,—I beg to acknowledge receipt of your favor of the 22nd instant, enclosing copies of certain papers and correspondence having reference to the disallowance of the Quebec Mining Act of last session. I will attend to the matter immediately.

Yours faithfully,
(Sgd.) T. CHASE-CASGRAIN.

DEPARTEMENT DU PROCUREUR GENERAL,
Quebec, 8th January, 1892.

The Honourable
Sir J. S. D. Thompson,
Minister of Justice,
Ottawa.

MY DEAR SIR JOHN,—Referring to your letter of the 16th December last, addressed to the Attorney-General of this Province, and having reference to the petition for the disavowal of the Quebec Mining Law of 1890, after having submitted the same to my colleagues, I am authorised to inform you that we have come to the following conclusion as regards the proposal you made in the above mentioned letter in the following terms:—

"I may be excused for suggesting that all difficulties might be removed by an amendment making it clear that the Act only applied to mines and minerals which belong to the Crown although not specifically reserved. In that case the legal questions which have been raised, and in respect of which there may, I think, be considerable doubt, would be left for determination by the courts."

Without in any way waiving any rights this Province may have to legislate on this matter, and without prejudice to said rights, this Government pledges itself to promote at the next session of the Legislature of this Province an amendment to the said Quebec Mining Law of 1890 to the effect suggested by you as above.

Should you not find this letter a sufficient assurance to enable you to make your report to His Excellency the Governor-General-in-Council on the subject of the Quebec Legislation of the last session, this Government is ready to pass an Order-in-Council to the same effect.

I remain,
Yours very truly,
(Sgd.) T. CHASE CASGRAIN,
Attorney-General.

HON. GEORGE IRVINE—I have only heard the papers read for the first time to-day, and I may say that in my opinion the result is satisfactory. I think we have reason to be satisfied with result of our negotiations.

CAPT. R. C. ADAMS—As far as I can judge, the Report is hardly a satisfactory solution, because it leaves the question open. We simply have the assurance that we may fight the matter in the courts.

HON. GEORGE IRVINE—What we were fighting for was to prevent the Legislature from taking away our titles. If the Quebec Government carries out the promise contained in the correspondence we shall have been successful in our contention.

CAPT. ADAMS—Still the fact remains that there is a question of conflict between the Dominion and Provincial Governments as to whether private owners of land have a good title. It makes public a very serious difficulty.

MR. S. P. FRANCHOT—Do I understand that this retroactive part of the Act is to be annulled?

HON. GEORGE IRVINE—Certainly.

MR. FRANCHOT—Do I understand that each individual will have to defend his title against all comers—the law is not laid down that mines upon private lands belong to the Crown?

HON. GEORGE IRVINE—No.

MR. FRANCHOT—Now if the retroactive clause of the Act be annulled, does it not give standing ground to say that they have no right to put a royalty upon such lands.

HON. GEORGE IRVINE—Royalty is only another name for tax. It is an incorrect expression.

CAPT. ADAMS—With reference to what Mr. Franchot has said, it seems to me that while things are left in *statu quo*, the whole statute is an uncertain one.

HON. GEORGE IRVINE—It is made uncertain by the Attorney-General of the Province of Quebec.

MR. FRANCHOT—Do they recognize it as an open question? They may do so; we don't. Suppose we invite capitalists to invest in the Province we must have the point decided beyond a peradventure.

HON. GEORGE IRVINE—The Act would only refer to land granted for agricultural purposes prior to 1880. There is no doubt about land subsequent to 1880, and with regard to phosphate, two years before—I think 1878.

MR. THEO. DOUCET—Still the question is one which is open to doubt.

HON. GEORGE IRVINE—We cannot help that.

MR. THEO. DOUCET—The all-important point is what effect will the present situation of affairs have upon the investing public.

HON. GEORGE IRVINE—The onus is thrown upon the local Government. It will have to prove its position.

MR. DOUCET—Still it will have a deterrent effect upon the introduction of capital.

HON. GEORGE IRVINE—I am afraid that is inevitable.

COL. LUCKE—The titles to the lots held by our company, which I have read over very carefully, reserve nothing to the Crown except pine timber of a certain size.

HON. GEORGE IRVINE—But yours is a mining grant; you will find thatit is registered as such.

MR. L. A. KLEIN—In the event of the present Government being defeated at the ensuing elections, will the succeeding administration be bound to carry out this Order-in-Council.

HON. GEORGE IRVINE—I take it that whatever Government is elected will be bound to do so.

Election of Officers and Council.

The following were elected officers and council for ensuing year: President, Hon. George Irvine, Q.C., Quebec; Vice-Presidents, Capt. R. C. Adams, Montreal; R. Prefontaine, Q.C., M.P., Montreal; S. P. Franchot, Buckingham; Treasurer, A. W. Stevenson, C.A., Montreal; Secretary, B. T. A. Bell, Ottawa; Council, D. A. Brown, O. M. Harris, J. Lainson Wills, F.C.S., Dickson Anderson, John J. Penhale, Col. Lucke, J. Burley Smith, R. T. Hopper, L. A. Klein.

It was decided that the next meeting of the Association should be held in the Eastern Townships in June, date, place and programme to be arranged by the following sub-committee: L. A. Klein, Col. Lucke, and John J. Penhale.

Messrs. S. P. Franchot, O. M. Harris, J. Lainson Wills and J. Burley Smith were appointed a sub-committee to arrange for the September meeting. This meeting will in all likelihood be held in the vicinity of the phosphate mines on the Lievres River.

This terminated the morning session.

The members re-assembled at two o'clock, the club-room being crowded, a pleasing feature being the presence of a large number of students attending the mining engineering and applied science lectures at McGill University. Capt. R. C. Adams presided in the absence of the president.

Technical Education in Relation to Mining.

SIR WILLIAM DAWSON—I propose merely to say a few words respecting our mining course in introducing Prof. Carlyle, who, I hope, will address you at greater length on the subject. The course of Mining Engineering in our Faculty of Applied Science was introduced about twenty years ago, under the able management of Dr. Sterry Hunt and Dr. Harrington, and has been one of the most successful in its results. Our aim has been to furnish all-round men, who, with a little practical experience should be able to make themselves useful in mining, mineral exploration and surveying, assaying or metallurgy. To secure this end, the course of study extends over four years, and includes those portions of the civil and mechanical engineering courses which are useful to mining engineers, as well as a thorough training in chemistry, assaying, mineralogy and geology; besides the special instruction in mining and metallurgy now given by one of our own graduates, Mr. Carlyle. The results have been very satisfactory in so far as the graduates are concerned. They have proved themselves useful, practical men, and have also shown a capacity and inclination to pursue original research in geology. Unfortunately, the demand for such men in the United States and other countries has been so great that but few have remained in Canada. This we specially regret, as we believe our own young men trained here are better suited than others to the work of developing our mineral resources. It is hoped, however, that as the number of our graduates increases, more of them may be induced to remain. On the whole, it may be affirmed that no professional men educated here have been more certain of remunerative employment or more useful than our mining engineers.

PROF. W. C. CARLYLE then proceeded to read his paper, as follows:—

The writer, having but recently returned from that great mining State, Colorado, where the last few years have been spent in work as a mining engineer in one of the most progressive and wealthy mining centres, he finds himself once more in Canada among Canadians, and one of the Faculty in engineering at McGill University. Having taken the course in mining at this college before leaving for the west, and having since then been associated very intimately in extensive mining operations with men of wide experience, this good opportunity has been taken to learn while working with other engineers and practical mining men, the real use or value to a mining man of a technical education.

We all are conscious of the feeling of suspicion and animosity towards young college-trained men, felt by many of those who, through years of constant practical work in mining, have gained large experience and also reputation; felt even by those not so familiar with its details and demands. It must be confessed that many college men have deservedly brought this distrust upon themselves, though unjustly upon their colleagues, by not having worldly wisdom enough to perceive that their book-lore and college training were not all-sufficient to make them thorough mining men, without having, as well, worked in the mill or smelter, or underground, with skilled and knowing millmen or miners having the countless but all-essential details that only such experience can give. Some such have undertaken, with too great self-confidence, operations far beyond their ability and practical knowledge, incurring certain failure and nonfulfilment of that they had glowingly promised. Fortunately, we are glad to say, this prejudice is fast being proved unwarrantable, mostly through the efforts and actions of collegians themselves, who, more wisely, on leaving college halls, have at once quickly sought out mining districts, and working with experienced men, having the all-important practical part, have made themselves, in many instances, men of pronounced success and reputation in the mining world.

We might now ask, What comprises a technical education in mining, as given at a well equipped college? In the first place, some subjects as given in the general course of education are taught, but chief prominence is given to subjects pertinent to the mining course, as mathematics, physics, chemistry, assaying and drawing. Besides laboratory work, the student takes up surveying in all its branches, surface and underground, and, proceeding, studies, theoretically and practically, mineralogical geology, which, to any mining man, in their real practical use in the daily prosecution of his work, cannot be overestimated. For, in the first place, he can correctly determine the rocks and minerals of his mining district, and being already versed in the history of similar formations, as carefully worked out by geologists in other parts, he is prepared already as to what to expect in his own mine or locality. Better still, acquainted with the general laws of rock formation; the occurrence and relationship of the different rocks to each other; the habits of slips and faults so often met with in mining; the peculiarities and the probable origin of the veins and ore-bodies, and what marvellous geologic changes have taken place and are possible—the floors of former oceans now lifted up to summits of lofty mountains, or lying all twisted and rent—all this knowledge helps him to arrive at more accurate conclusions, and to avoid following theories and ideas entirely absurd and wrong. Of this last fact the writer has often been impressed, even amazed, while working among old and experienced miners, whose geological education had been gleaned from what they themselves had seen, to hear their very fantastic and impossible explanations of peculiarities in ore-bodies and formations. Geology is not a theoretical or ideal study, with constantly changing argument and classification, but yearly it is becoming more and more a valuable practical science and strong factor in an engineer's training.

In Leadville, about ten years ago, Emmons, the famous geologist of the United States Geological Survey, made as complete and exhaustive examination as then possible of that wonderful silver mining camp, unravelling the intricacies of the systems of faultings, and reaching such definite conclusions as to the relationships between the ore-bodies and the enclosing limestones and porplyries, as were explained in his monograph with its accompanying maps and sections, that these have become the guide to all classes of miners, who have been compelled to acknowledge the usefulness of his researches, by the wonderful manner in which subsequent developments have proved the correctness of his views.

Other subjects of equal importance to a mining engineer are taught, such as applied mechanics, hydraulics, steam, electricity, construction and designing, and so well equipped are our colleges becoming that a man is not confined to book-work and the lecture; he can now work with the mechanics himself, test and compare the strengths of materials of construction, and experiment with different forms of structure. In mining itself he is told of the best methods of work, of the best and cheapest kinds of machinery for hoisting and pumping, of plans for dressing ores, and their transportation.

Through the great liberality of Mr. McDonald and other friends of the University, the engineering department at McGill will soon be able to offer young men entering this profession facilities of instruction unsurpassed in America. With their large buildings, completely equipped with extensive workshops, testing machines and laboratories, and with a corps of experienced men as professors and instructors, the student graduating here as an engineer will have had a course eminently

fitted to help him very materially in his after work. It is hoped and expected that before so very long the University will be able to erect and fully equip a metallurgical department, to be used in teaching metallurgy, practically, just as it would be seen in the mills, and in testing to determine the best and cheapest process of treatment for any particular ore. Such a laboratory will be supplied with regular machines, such as rock-crushers, rolls, stamps, amalgamating plates and pans, vanners, chlorinating and leaching plants, concentrating machinery, and the different furnaces for calcining, roasting and smelting. With such equipments, not only will our students become thoroughly aequainted with the different systems of treating ores, learning practically how to handle the ores and different machines: but mining men throughout the Dominion, desirous of learning the proper method to adopt in building a mill to treat their ore, will thus be able to have their ores systematically treated by the different processes, thus determining the method, the cheapest and best adopted.

A young man having thus taken a technical course in mining, will leave college educated, and familiar with surveying, assaying, analyzing, geology and mineralogy, with more or less experience in developing and working a mining property, and afterwards correctly treating its ores. If a man, capable and intelligent, with such a training, will complement this knowledge by at once entering and studying the strictly practical part of his work, going, if needs be, to the great mining centres of the other side, where mining and metallurgy are reaching such a high state of progress, such a man, thus doubly equipped, cannot fail but be a success in his profession, and a benefit to the locality where he labors. That such a training is valuable cannot be better evidenced than by the fact that in the large mining schools of the west the majority of the students are sons of mining men, who, having felt themselves many times hampered by the lack of such an education, are giving these young men the valuable opportunity which was denied to them. Again, throughout the west, by far the most of the best economical and scientific mining is being done by engineers and mining men who have had technical educations. The writer is well warranted in this statement.

In Canada our mining is as yet but just begun, thwarted as it is by defective and senseless laws. But the time will surely come when mining will be an institution of our Dominion, in economic as well as precious minerals, and men with both technical and practical experience will help in its development, encouraging capital to venture, and then making good its venture. With this great increase in the mining industries, Canada will receive large additions to her income, making her stronger and wealthier, as her great resources promise that she shall be in the not far distant future.

MR. B. T. A. BELL—For the benefit of Sir William, Prof. Carlyle, and the students who were not with us at our morning session, I would say that the Association will always cordially welcome the students of mining engineering and the professors at McGill, to take part, not only in the meetings of this Association, but also in the excursions to mining districts, where an opportunity may be had by the students of studying the methods of winning and treating the various mineral products of the province.

The chairman then called upon Mr. J. T. Donald, M.A., Montreal, to read his paper.

Canadian Platinum.

It has long been known that platinum had been found in the Province of Quebec. In the Report of the Geological Survey for 1851-52 it is stated that Dr. Hunt had detected native platinum in some of the gold washings of the Chaudière district.

In the Province of Ontario platinum has been discovered in the Sudbury district. It there occurs in combination with arsenic, forming the mineral Sperrylite, which is of great interest, as it is "the first mineral yet found containing platinum as an important constituent other than the natural alloys with various metals of the platinum group." So far as can be learned, no effort has yet been made to utilise Sperrylite as a source of platinum, but at present it brings a high price as a mineral curiosity. Canadian platinum ore, as a commercial article, is entirely the product of British Columbia. In association with alluvial gold it has been met with in a number of the streams of that Province. At present the most important platinum-bearing district of British Columbia, as well, indeed, as of North America, is that of the Tulameen or North Fork of the Similkameen River. Placer mining in this district yields both gold and platinum, the latter being found, like the gold, in grains and small nuggets. A notable quantity of platinum has already been obtained from this district. One firm in the United States claims to have purchased within the last year or two fully 2,000 oz. of British Columbia platinum, and it is well known that a portion of the yield of this district has found its way to the London market.

An increased output may be expected as the Tulameen Hydraulic and Improvement Co. have made preparations to begin hydraulic mining on a large scale with the advent of spring. Mr. R. G. Tatlow, a member of this company, informs me that his company has erected a saw mill, having a capacity of 5,000 feet per diem, and has constructed about two miles of flume, 5 feet at base, 20 inches high, on sills placed on solid bed about 7 feet wide, and having a grade of ½ inch in 12 feet. The water is taken from Eagle Creek, about 14 miles above Granite Creek, the only creek capable of giving the necessary quantity of water and pressure. In addition to this flume, the company has on the ground, and ready for work, about 400 feet of iron pipe and a monitor, which, where work is to be commenced, will work with a pressure of 900 miners' inches, and a drop of about 160 feet. Mr. Tatlow also states that the largest yield of platinum appears to have been in the vicinity of and below Eagle Creek, where the yield has been about two parts of gold to one of platinum.

The two samples of this Tulameen ore before us contain, 69.28 and 72 per cent. platinum.* It is really a very complex alloy of platinum, with a number of the comparatively rare metals of this group, such as palladium, iridium, and notably an alloy of Osmium, and iridium, known as osmixidium, which in grains of proper size and form is used for pen points. This ore is worth to-day about $5.50 per oz. troy. The price is very unsteady, being determined by the demand for the metal, and by the state of affairs in Russia, the principal producer of the ore.

The value of platinum depends chiefly upon its ability to resist high temperatures and the action of the majority of chemical reagents. Its value to the chemist is well expressed by Liebig's statement: "Without platinum it would be impossible in many cases to make the analysis of a mineral; * * without platinum the composition of most minerals woud have yet remained unknown." In the forms of foil and wire, and wrought into crucibles, evaporating dishes, etc., it is in constant use in the laboratory; but its use is not confined to the laboratory. It is employed on a large scale in manufacturing chemistry, for example, in the concentration of sulphuric acid.

In 1888 platinum in the form of pans, retorts, etc., to the value of $12,268, was imported into this province, and it is understood that practically the whole was imported for use in the sulphuric acid works in Capelton.

Dr. D. T. Day in "Mineral Resources of the United States," 1887, states that a use involving a large and steady consumption of platinum wire is for stems on porcelain teeth. It is estimated that 40,000 oz. of platinum are thus consumed in the United States yearly. In the form of wire it is also used to a large extent in electrical appliances.

An interesting statement in connection with the metallurgy of platinum was made by the president of the chemical section of the British Association, at the meeting of last year. It is to the effect that one firm of refiners in London have such facilities that 2½ cwts. of platinum may be melted in a single charge, and that the same firm, in a single operation, extracted a mass of palladium valued at £30,000 from gold platinum ore actually worth more than a million sterling.

Hon. George Irvine having taken the chair, Capt. Adams proceeded to address the meeting on the subject of

Mining Luck.

CAPT. ADAMS said:—

I fear it will seem almost sacriligious for me to intrude upon this meeting, where we have heard so much of scientific wisdom from eminent men, with considerations of the pecuniary results of mining operations. But perhaps the turning of our thoughts in this direction for a few moments may afford some diversion and may enable us the better to consider the serious topics which have been presented to us, and those that we are yet to receive.

Under our present competitive system in which we earn our living by exploiting the pockets of others, the motive of those who engage in mining is not primarily to supply the world with minerals as a philanthropic effort, but to make money for themselves. The practical question of mining, to those of us who engage in it, is, ultimately, how much of the contents of the mineral pockets and veins can be transferred to our own pockets?

The mining industry is doubtless one of the most beneficial in the world and adds directly to its wealth, but we do not follow it because it is a service to mankind, but to benefit ourselves, and although this may be called a sordid view, it is the fact that the pursuit of mining depends upon its profit. I therefore feel that it is quite legitimate that we should turn our attention this afternoon to the topic of Mining Luck, and by luck is meant the result of circumstances beyond our control.

Statisticians tell us that in commercial enterprises three per cent. of the people are successful, and that ninety-seven per cent. fail. I am not sure how accurate that is, but I have read in Chambers' Encyclopœdia that ninety-two per cent. of the mining capital in the United States has been sunk, only eight per cent. realizing, so that any one can see that the mining people were five per cent. ahead of the commercial men. I do not know whether this would apply to Canada.

I was standing before a vein of mineral a few months ago, and predicting a large output from it, when the manager turned to me and said: "I have been engaged in the course of my life in almost every mine in Canada, and I have never known one that has succeeded." I thought that he was talking in a very hopeless way, but I can only say as a result, that the vein I looked at did not succeed, and added one more to his disappointments.

Success in mining operations has not been always due to the extent of the mineral deposits. We know that a good deal of the profit that has been made in mining operations has been made by deals in shares. A mining engineer, who was employed in the Comstock mine, told me that some of the fortunes that came from that wonderful lode came, not from the ore that was got out of the mine, but was got by operations in the shares; and he tells me that when a remarkably rich vein was met, in some cases it was secretly guarded; sentinels were put on the mine and work was done designedly in poor ore; the dividends going down, of course the shares went down, and the people in control bought them. Then the original veins were opened up, and great profits were made, and large dividends were declared, and when the stock had gone up to remarkable figures these people unloaded it. I do not know how accurate this account may be, but from all I have heard there seems to be some truth in the statement that many of these great fortunes that we hear of have been made, not altogether from the pockets of ore, but out of the pockets of the credulous public. We know, too, that a great many of the operators in mines—the discoverers, the men to whom we really owe the exploitation of this wealth—have not reaped the benefit; for, like inventors, they very often fail to derive the benefit of their work.

It is said that Marshall, who discovered gold in California, died a pensioner of the State. Colton, the discoverer of the Bob-tail lode of Colorado, settled down upon a little ranch on the Platte River. Comstock, died in poverty in Montana. This has been the history of a large number who have been instrumental in opening up the veins of ore.

We know that the men who have invested in many of these enterprises have been unsuccessful. Once I had the temerity to ask a Boston man to invest in mining near Ottawa, and he said, "Do you think we are going to put our money in the wilds of Canada? We prefer to invest at home, in Colorado or Montana." But one gentleman whom I accosted, quietly went to his safe and handed me a package, saying that it represented in mining certificates a half million dollars which an old gentleman had quietly invested on the sly, and he said that of all this half million dollars only one compaay had ever paid a dividend. That was his experience concerning mining investments, but he did have something; he had the most wonderful collection of engravings that I have ever seen; the certificates were covered with rising suns, moons, stars and mining devices, and it was a very beautiful display of artistic work. I remember the remark of the president of a Boston bank to whom I also spoke in the same way. He said, "I would not invest a dollar in digging if the chance was offered to me by the Angel Gabriel," which shows the impression that had got abroad in reference to mining enterprises. One of these gentlemen, who was a large shipowner, told the captain who had charge of one of his vessels that misfortune was a fault in nine cases out of ten. He did not believe much in luck.

This same man sent out his ship loaded with a cargo of ice, in command of this young captain, and three days out from Boston the ice ship caught fire. He discharged the captain, and told him that although it was not his fault, a young man on his first voyage ought to be lucky.

I would like to mention, as I have spoken rather discouragingly of investments in mining, of what luck has done for miners, that we may take perhaps a little encouragement from some of their experiences. I remember once seeing Mr. Woodward, in San Francisco, and learning these particulars of his history: He was engaged with a pair of mules in transporting goods to the mines, and one day a couple of miners came out "dead broke." They said they had a claim which they had been working unsuccessfully, and that they had abandoned it. The driver was also disheartened, and said that there was also very little money in his business. These miners offered to give up their claim for his mules, and he decided to take the venture. He changed his mules for the mine, and it turned out to be the famous Gould and Curry mine, the shares of which were sold at over two thousand dollars each. The man who went it blind, and changed two mules for a mine, became a millionaire.

You have all heard of the Sarah Sands nugget of Ballarat, Australia—the Welcome Nugget, as it is called, a model of which can be seen in some of our museums, which weighed 233 pounds 4 ozs. troy, and was worth about $54,000; and another discovered in Donolly District, Australia, in 1869, which weighed 2,520 oz. and was valued at £9,600.

A good many stories are told of the Welcome and other large nuggets which may have some foundation, showing that it was an element of luck that in a great measure secured their discovery. It was stated of this great nugget that three miners were working in the vein, and being discouraged they had determined to work one day more and then cease. The evening had come and they were going to leave when one man took up his pick and said "One more stroke for luck." He struck and saw something gleaming; the others saw that he had found something and joined him, and in a little while they brought out this immense nugget. Another version I have heard of this story was, that one of these men was a sailor who had run away from his ship and had gone to the mines. He afterwards went back to Melbourne and there was accosted by the captain of the ship who wished to arrest him as a deserter. He told the captain he would pay him off. So he bought the ship from the agents and went home captain himself.

I have read that in Colorado a man prospecting discovered a mine, and thought he was very fortunate in a little while in selling it to four men for twenty-five thousand dollars. The persons to whom he sold it worked it, and all at once found they had an immense deposit of silver. The result was that after clearing several millions they sold the mine for thirteen million dollars,

* A complete analysis of ore from Granite Creek appears in the Report of the Geological Survey for 1886.

and at the time they sold it it was stated that there was thirty-seven million dollars in sight. That was the famous "Horn" Silver mine.

Last spring, in London, I was told by some of my friends that about three years ago they purchased ten thousand shares of a run-down Colorado mine for sixpence a share. They went to work on it and in two or three months came across large bunches of silver ore. Those shares that they paid sixpence for are now selling for three pounds a share, and dividends of 40, 60 and 80 per cent. have been paid. The mines were at Ouray, Colorado; the New Gustan, the Yankee Girl and the American Belle. It is seemingly to luck that they owe these great awards.

I have been told that the largest show that they ever had in the famous "Emerald Mine" was found when a man, in skylarking, pushed another against a tree stump, which turned up and showed phosphates at the roots. This, being followed, led to the largest show that they ever had there. We have seen the element of luck lately in our phosphate mines, which, owing to the competition of Florida phosphates, have become unprofitable. Many of our mines have been troubled in the past by dark coloured mica, which was worthless and an injury to the quality of the phosphates, and had to be thrown away. But all at once it was discovered that this is a most valuable electrical insulator, and some mines will be able to keep open by the combination of phosphate and mica mining.

It is sometimes stated that mining is gambling with God; the people bet that there is a certain thing in the ground. They are betting against nature; and mining is gambling. But money which is spent on it is not really put in a hole in the ground, for even if not profitable the money goes into the pockets of deserving people—people who are working hard. It promotes a great many contingent interests in the country, and the men who have not made profits themselves, may certainly feel some satisfaction at the benefit resulting from their investments that the money spent in this way developed the country and benefited directly a great number of worthy people.

There is one great encouragement, I think, from this element of luck in mining, which is that ability is not essential to success as it is in some other departments. If one desires to be eminent in geology, as Sir William Dawson; or in chemistry, as Doctor Harrington; or in mechanical arts, like many of our friends; we know that a great amount of intelligence and brains, as we say, is necessary—that it is a matter of learning and skill. But almost any average person may become a successful miner. Learning is not by any means excluded from the field, for no doubt, as Professor Carlyle has told us, those with a technical education succeed best. In mercantile circles we know that a man must be shrewd, but even if he is not so there is a chance for him in mining if he only has the elments of courage and perseverance.

A miner has to be industrious and persistent in intelligent effort, and he must not be discouraged even if people tell him that he is dropping buckets into empty wells and growing old in drawing nothing up, that he is a crank and that he is beating his head against a stone wall. In spite of this a miner must be a man who will never say die while he has a shot in the locker; he must not know when he is beaten, and must not despair when he is down on his luck. He must have tact, perseverance and hope, and he must remember that although there is a good deal of chance in his undertakings, the words are true which have been written by Oliver Wendell Holmes:—

> "Be firm! one constant element in luck,
> Is genuine, solid, old Teutonic pluck."

(Loud applause).

Mr. H. S. POOLE, F.G.S., Stellarton, having been called on said: I am in the unfortunate position of one who is employed and does not look to the profits for his pay, but I am afraid from the experience of that section of the country from which I come (Nova Scotia) that it is perhaps a safer position to take. I have experienced great interest in listening to the last paper, because it reminds me of a little experience in the west some time ago: We were going into a small mine which was practically abandoned, and where there was one man working and as I went round I put one or two samples in my pocket, and after returning to my own locality I made several assays, and to my surprise after working it over I found a large proportion of silver, and it turned out that the lumps I had taken out were worth some three or four thousand dollars to the ton. The result was that the mine was sold again to the man who took me round, and who was "dead broke" at the time, and he got eighteen thousand dollars for it. As regards the coal mining generally, I don't think I have anything to say. I have had great pleasure in listening to what has been said, and to enjoy the society of the members, since you have kindly given me the invitation, but not to endeavor to add to the amusement, certainly not to the instruction, for that is beyond my ability.

Dr. Robt. R. W. Ells, of the Geological Survey, then read a paper on

The Importance of a Knowledge of Geology and its Kindred Subjects to the Mining Engineer and Prospector.

Few professions probably call for a greater amount of clearheadedness, or for the exercise of that faculty, enjoyed unfortunately by certain persons only, of taking a clear but comprehensive view of all sides of any problem which may be presented, than that of mining engineering. For not only must the mining engineer become the guardian and trustee of great and important interests, comprising frequently the investment of millions of dollars of capital, and the employment and general oversight of hundreds of men, but he must, by the shrewdness of his judgment, and by the exercise of the skill which he may have acquired either by dint of hard labour and experience in the pursuit of his profession, or by the acquaintance, in the first place, of the accrued knowledge of the school, be prepared, both to direct properly the expenditure of the funds intrusted to him, in the way which shall return the greatest possible amount of profit to the investors, either directly or in such a way as shall lead to large future dividends, and to provide as well for the welfare of the men under his control. To do all this requires the possession of several very important attributes, among which may be mentioned a good stock of plain common sense and the ability to use it, sound judgment, clear and quick powers of perception; and, in order that all these may be most profitably directed, a thorough preliminary training with technical matters pertaining to his profession. Granted that our mining engineer is equipped with the requisites just stated, it is needless to remark that the accomplishment of such desirable results as are anticipated by every board of mine directors must still depend upon several conditions, while primarily it may be said that very much of the success to be hoped for will depend upon the amount of skill enjoyed by the guiding spirit of the work in hand. A still more important factor as regards the success of such operations is the selection of a proper location, which shall contain a sufficient quantity of mineral matter to warrant the outlay of the capital contemplated, without which, indeed, the most surpassing skill of the mining engineer will be of but little avail.

The deposits of the metallic minerals which are stored up within the earth's crust are arranged with regard to the operation of certain well recognized principles. That all these have yet been ascertained is too much to hope for, but it can be safely asserted that very much valuable information of vast practical benefit in regard to the mode of occurrence and distribution of our principal economic minerals has been obtained, and from these a series of carefully drawn conclusions are now available for those who choose to employ the most fitting instruments in the search for the world's mineral wealth.

In the location and development of our mining centres, we should consider, prior to the operations of the mining engineer, the work of the mineral prospector, who may be justly regarded as the pioneer in most mining enterprises; for while it must be stated that the determination of mineral horizons, the conditions of mineral occurrence, and the prospect of successful working or otherwise, are questions which more particularly come under the consideration of the scientific explorer, to the prospector, as a class, it must be confessed that the credit of finding most of our workable mines is due. In the prospector himself we have a wide range, not only as regards the capacities of the individual, but as relates to the method employed in the search for mineral deposits. Thus in the old book of Agricola we find curious illustrations of this class of men, engaged in the attempt to find mineral veins by the aid of the divining rod, called also the *dowsing* or *mineral* rod. Many of you may suppose that this strange instrument of so remote a time should have long since passed into disuse, but such is not the case, for in most countries, even at the present day, the use of the divining rod in the search for mineral veins, buried treasure, and for finding water, is still common. The belief in its efficacy is, moreover, not confined to the uneducated or ignorant by any means, but in several instances which have come under my own personal experience, it has been largely employed by professional men of high standing in the community; and upon its curious antics, many thousands of dollars have been expended in the search for the hidden wealth it was supposed to point out. So complete, moreover, was the faith of these men in this curious instrument, that in spite of the constant failures which attended their efforts, dependent upon the indications of the rod, they still remained firm believers in its value as a test of mineral locations. So important has the using of the divining rod been regarded in some places, that so high an authority on the subject of mining as Dr. R. W. Raymond, has written an exhaustive treatise on the history of the instrument, which appeared some years ago in the Transactions of the American Institute of Mining Engineers.

By others, again, prospecting is attempted through the assistance of the clairvoyant's art, if art such methods can be called; and even in this country, educated men, who apparently enjoy unlimited common sense with ordinary affairs of everyday life, have been known to consult such sources of information as to the location of concealed mineral veins upon whose dictum it was proposed to expend large sums in the attempt to find such deposits by the process of shifting; all of which goes to show that the age of superstition has not yet entirely passed away and that there is probably no branch of industry in which so many men take such pleasure in being humbugged as in the ancient business of mining; and none in which men of sound business ability, otherwise, are so credulous or so readily accept the word of a mere adventurer, who may have chanced to pick up a few scientific and technical terms, of which in nine cases out of ten he knows not even the meaning, and upon the strength of whose advice large sums are rashly invested in the purchase and development of properties which are practically worthless. It is a curious fact that when persons of certain temperaments are infected with the mining craze, they proceed to lose very much of their aforetime sound business caution, and there is no doubt that in certain cases this mining fever develops into a form of mild insanity, harmless in general to everyone but the person so infected, but in his case very rarely running its course until every available penny, both of his own property and that of his friends who may be prevailed upon to invest, is most effectually wasted.

While there is apparently no reason why any one should attempt to interfere with the disposition of private funds in the direction of mining investments by anyone who may be predisposed to throw away his personal property in the useless attempt to extract blood from a stone, there are certain conditions from the standpoint of the public and the country's welfare which warrant the presentation of a few facts bearing on the subject. For instance, if the private investor himself were the only one to suffer through the folly, or perchance the knavery, of such representations on the part of an incompetent or dishonest prospector, or so-called mining engineer, the evil would be easily compassed, but unfortunately it has been too often the case that, through the fraud or craft of certain individuals connected with mining matters, or, leaving out the question of fraud itself, through their credulity or ignorance, great harm has resulted, not only compassing the total loss of the private and often limited means of persons who have thereby been reduced to complete poverty, but in some cases has also resulted in great injury to the legitimate mining interests of the country at large.

And first of all, without making any invidious distinctions, it may be remarked that there are prospectors, or so-called mineral experts, who are honest clear through, and who are therefore, in so far as their honesty goes, reliable men and worthy of credence. Whatever mistakes such men may make as to the value of a mining district are, in their case, to be attributed to a lack of knowledge regarding the conditions which govern the occurrence of the mineral sought, in profitable quantity, or to an error in judgment. These are men who very frequently undergo great hardships. They bear, without complaint, the trials and discomfort which attach to exploration in the wild and rugged districts to which their enterprise calls them, and in many of these men the country possesses no braver or more useful citizens. To them, also, it must be conceded that their rewards are, in many cases, but little commensurate with the toil they have to undergo, or with the frequently valuable discoveries which they accomplish. But there are also prospectors of a very different class, as you all know, whose desire, primarily, is to make a good thing for themselves or their employers, regardless of the actual merits of the case. There is a class of men, frequently plausible in the extreme, whose statements as to the value of a mineral location it would always be well for the honest investor to confirm before definitely accepting. While there is no doubt that, taking the class of prospectors as a whole, the dishonest men are in a very decided minority, there are certain features of the craft which to the greater part of prospectors are but little understood.

It has already been remarked that there are certain principles which should guide us in the search for the more important economic minerals. Thus we know, by the study of the earth's crust, that certain series of rock strata, all of which have received their proper place in the geological scale, are more likely to contain certain minerals than other formations. For instance, our apatite deposits, in so far as we know them in workable quantities, all over the world, are found only in the rocks which we call Laurentian, and which are the oldest known in the earth's history. Other deposits of phosphate of lime occur, in composition somewhat similar to apatite, in nearly every rock formation from the Laurentian up to the Post-Tertiary, but they are distinct in character from the apatites of the Archean. Again, we look for coal for the most part in the rocks of the Carboniferous system, and we rarely find it in workable quantity in any other series, though we do find it in certain newer rocks, like the Cretaceous, etc., but we do not look for coal mines in the Silurian, any more than we look for apatite in the Carboniferous, because experience teaches us such search would be unprofitable; and so when we read of the discovery of great seams of coal in the Provinces of Ontario and Quebec we are disposed to smile, because the story is an old one and has been often disproved. Thus we might state the probable position of most of our economic minerals, as, for instance, the copper and nickel in the Huronian, the graphite and mica in the Laurentian, the asbestos, gold and silver in the Cambrian, etc.

While to many of our brethren of the mining profession these facts are familiar, and the mode of occurrence of the greater part of the economic minerals is well known, this knowledge from the scientific standpoint is apparently largely a sealed book to others. It would, therefore, seem to be an item of primary importance in the search for mineral lands, that the prospector or pioneer of the industry should possess some small acquaintance with the principles at least by which their explorations might be most profitably conducted and their zeal and energy turned to the best account.

In the report of the Royal Commission on the Mineral Resources of Ontario, lately published, several passages occur having a direct bearing on this aspect of the question, and are worthy of being quoted. Thus, Mr. Coe, one of the Commissioners, says that during "their travels through Ontario the Commissioners were constantly meeting explorers who did not seem to have any idea in reference to a starting point to their working, but were travelling through the region at random, trusting to chance to make a discovery. Quite a number had spent months unsuccessfully in pursuit of what they would have been

able to determine in a very short period had they the necessary knowledge to guide them." And in the remarks on "Technical Instruction" the report also states that "The witnesses examined by the Commission are almost unanimous in the opinion that there is great need of technical instruction in all operations relating to the mining and metallurgical industries of the Province. Few of the men who prospect for minerals have the practical knowledge which would enable them to explore the country intelligently or successfully. Time and money are often wasted in searching for the precious and economic minerals through districts where there are none, and where nature never designed that any should be. Some knowledge of the geology of the country and of rocks and minerals, and their relation to each other, is of obvious advantage to the prospector, and if he is also able to use the blowpipe or make the ordinary tests for metals, his quest cannot fail to be infinitely more satisfactory than it could be without such knowledge, and he may be saved from much disappointment. Some were unable even to make the common and simple test of minerals under the knife, and it is doubtful if one man in ten could make a map or sketch of the district he had examined, so necessary for good prospecting work."

There is another class of men engaged in mineral development, known by the title "practical miners," who exercise a very considerable amount of influence in mining matters, concerning some of whom the peculiar ideas and methods of work deserve at least a passing notice. The practical miner as a rule surpasses the prospector in the variety and the depth of his knowledge. He very frequently assumes to pronounce with much boldness and confidence upon the probabilities of successful work from very superficial and inadequate data, and the opinion of a so-called practical miner is apt to be taken by a certain class of investors as worthy of the utmost credence. Trained as most of them are by actual work in some underground mine, either of gold, copper, coal, or some one of the many economic minerals, some of these men, not all, come to consider that the occurrence of all minerals is governed by the conditions which exist in the particular locations with which they are familiar. It has been doubtless the experience of many of you to know such men—men who glance over the surface of the tract of land which they propose to develop and who, from some peculiar configuration of the landscape which reminds them of the features of the district with which they are acquainted elsewhere, proceed to argue straightway that like conditions of surface or of soil must lead to similar conditions beneath, and that if successful mining has been carried on in this typical district the conditions here should also warrant a like amount of expenditure. Among them are the men who are frequently found preaching the advisability and desirability of deep-shafting on the hypotheses that a shaft is always useful, rather than the adoption of the more modern and scientific method of exploring by boring, when the latter would be equally as valuable at a fiftieth part of the expense. These are the men also who if they find vein matter at the surface straightway consider their fortunes made, in accordance with the general theory that all veins increase in richness and value as they are followed downward—a point by no means established, since, while it may be true of certain veins occasionally, experience has taught us very plainly that the principle is far from being one of general application. Very frequently such practical miners assume the lofty and patronizing tone towards the scientifically trained expert, and, if in charge of important mining developments, tolerate the visits or examinations of such experts as matters of but litttle importance, and the conclusions arrived at by them after close study as still less so. These are the men also who, frequently promoted from the pit head or the pick to the position of managing engineer, are sometimes responsible for the occasional accidents which at intervals fill our souls with horror as we read the details of the suffering and death caused by the carelessness or the incompetence which should not have been tolerated for one moment after the indication of danger was made known. Not being aware, however, of the source of such dangers, or ignorant often of the means by which they might be forestalled; or through lack of that training which should ever keep one in a place of such fearful responsibility as some of our deep mines entail, on the alert to guard against every danger which can be shunned, matters are perforce too often allowed to go on in their usual happy-go-lucky style till at last the grand crash comes, and the whole land is plunged in sorrow.

To this class also belong the men who shine conspicuously as designers of fanciful sections of rock strata intersected throughout with rich mineral veins, which exist only in the artist's inner consciousness, and who furnish also the statistics of production (estimated) which make so promising a display in a prospectus intended to draw; often, indeed, before the slightest attempt has been made to ascertain anything whatever concerning the actual condition of things beneath the soil or even at the surface. The marvellous stories as to the wonderful wealth about to be uncovered not infrequently succeed in extorting the required amount from the pockets of credulous stockholders, who, in by far the largest number of cases, have to acquire their experience by the payment of good, solid cash, and to whom such experience presents the only form of dividend likely to follow from their investment.

This, however, is only one view of the case. From the celebrated mining schools of London, Frieburg, New York, Montreal and other places, scores of men have been annually graduated for many years in the department of mining engineering, who, in addition to the technical qualifications more directly pertaining to the successful development of the mining industries of which they have the control, possess very good knowledge of the various geological and mineralogical conditions which first of all are requisite for the complete understanding of the many puzzling questions constantly being presented as the work proceeds. Among such subjects with which the mining engineer should become familiar, is the question of faults, their direction, disposition and extent; the presence and action of intrusive dykes of various kinds; the frequent change in strata encountered, and the study of the new conditions set up by such change; the character and mode of occurrence of the mineral veins or beds, as the case may be, and the arrangement and age of the rock strata in which the work is being carried on; together with many other problems which have an important bearing upon the successful carrying out of the proposed operations. In countries where a careful geological survey has already determined the conditions favorable or otherwise for the finding of profitable deposits of minerals, such knowledge may not at first sight appear so requisite to the mining engineer, but very often the mining engineer must, to a certain extent, precede the geologist. Just how such scientific geological knowledge may be applied may seem an undeterminable problem to many, and in illustration we may take some of our mineral deposits in the Province of Quebec. For instance, we all know that asbestos is found in serpentine rocks. To many the kinds and conditions of these rocks are unknown. The serpentine of one locality appears as likely to be profitable as that from another, and consequently thousands of dollars have been and will be spent in the fruitless search after asbestos on the present evidence of two or three small and straggling veins of no economic importance, with expectations that these are speedily to change their character and become large and profitable deposits. Now, had the mining engineer in charge of these developments fully understood the fact that there is a marked difference in the kind and condition of serpentine rock, depending upon age, origin or other cause; and had he known by careful study of these conditions, what serpentine was likely to yield asbestos in paying quantity, and what serpentine would yield him no asbestos, let him look ever so diligently, much unnecessary labor and capital might be saved. So also in our copper deposits. Those who have read of the great boom thirty years ago, know that hundreds of areas were prospected, placed on the market and sold for fancy prices. Many of these, upon the attempt being made to operate them, were found to be valueless; the copper occurred under such conditions as to render its extraction profitless. Of the many capitalists who invested in copper properties, or mining engineers who attempted to develop these mines, probably not one in fifty ever set himself to study the conditions under which profitable copper lodes existed, or where the chances were so slight that failure was almost certain. Yet we now know that the copper mines of Quebec occur in rocks of different geological horizons, and that the deposits in one part are generally in large amount and of a certain kind of ore, which can frequently be worked at a profit, while, in the rocks of a different formation, where the indications so-called are frequent, the ore is of a different quality, and the quantity such as in most cases not sufficient to pay for the expense of extraction. Thus, for instance, the ore of the one area is a chalco-pyrite, valuable for sulphur; of another pyrrhotite, in which the greater relative proportion of iron is such as to render it unprofitable in the present state of the market for the extraction of copper or sulphur, although the quantity is frequently very considerable; while in yet another case, the ore is exceedingly rich, but the quantity very limited; so that while there appears to the casual observer to be a sufficient amount to warrant development, experience, often bitter, has shown that such expectations have been so rarely realized that the whole may be considered failures. Precisely the same mistakes are made in connection with the coal deposits in the Lower Provinces. Thus, while there are beds of enormous thickness at Pictou, Springhill and Sidney, which are almost practically inexhaustible, these are confined to a certain portion of the middle carboniferous formation known as the productive coal measures. Other seams, however, occur in a lower part of the formation known as the millstone grit, and even in the lower carboniferous formation, and attempts have been made to work certain of these, generally without success, except very locally, and under certain peculiar conditions. Now the rocks of the productive measures and of the millstone grit, while possessing certain features in common, such as the occurrence of shales and sandstones of various colors, are yet, to the trained geologist, distinguishable, and no one who understood the true conditions of such a case would advise the payment of large sums of money in the acquisition of a so-called coal area, on the presence of a thin seam of coal only, when the rock could be recognized as of millstone grit age. Yet how often is this attempted, and how many persons have had to deplore the lack of proper geological knowledge on the part of themselves, or of the mining engineer employed, through whose advice a sum of money vastly disproportioned to the value of the property in question was, to put it plainly, squandered; and so instances might be multiplied. There are certain conditions, favorable or otherwise, in many supposed mineral localities, which become clear when studied under the light of experience. Yet, strange to say, in very many cases the advice of the geologist when asked in regard to the prospects of a certain location, should it chance to be unfavorable and not in accordance with the wishes of the owner, is confidently disregarded, with the remark that scientific theories are of no value anyway as regards successful practical workings. I imagine there are not many of us who cannot recall some instance of the foolish and useless expenditure of money in the vain search for mineral wealth in opposition to the expressed opinion of the well-trained geologist. Very often the declared opinion of the practical miner, who confidently knows all the conditions, is preferred, though the consequences of following such advice, in many cases, are disastrous in the extreme.

It is a lamentable fact that of the many highly trained graduates in mining engineering who pass out annually from such celebrated schools as McGill possesses, scarcely one finds employment in connection with the mineral development of our own country. If this total lack of appreciation of the value of scientific training on the part of our mining engineers by our mine owners and capitalists could be attributed to the absence of mineral deposits in Canada of value sufficient to be opened or operated properly, it might be deplored. On the contrary there is probably no country in the world where the supplies of mineral wealth, in nearly every form, are more abundant than in our own Dominion. Such negligence of our trained mining engineers cannot, moreover, be due to a lack of ability or qualifications on their part; for we find that when they seek their fortunes on the other side of the boundary they very speedily fill exceedingly important and lucrative positions in charge of mining works. If we look at our mining centres and examine the qualifications of those in charge of even our most important mines, we can but be forcibly impressed with the fact that by far the greater number of those in charge are lamentably wanting in even the rudiments of scientific training. Would it be too much to say that, in all probability, the present unsatisfactory condition of our mining industries in Canada to-day is due to the fact that, possibly in order to save the payment of a decent salary to a man qualified to undertake the successful development of a mine, some one, ignorant of what is requisite to success, is placed in charge. Not only is the managing engineer, so-called, often deficient in the technical qualifications requisite to properly open and work the property over which he has control, but very frequently he possesses no mining qualifications whatever, and has not even the smallest idea of what should be done. While in every other business in life it is thought desirable to place the management in the hands of men who understand best how its affairs should be conducted, with an eye to profitably carrying on the industry, in mining only does the principle seem to apply that no special qualifications are necessary, save that of drawing ones salary monthly. It is certainly not saying too much if we suggest that were our mining industries as a whole placed under the control of men who were educated, not only in the technical branches of their profession, but in the other scientific departments as well—as, for instance, the principles of geology and of mineralogy—the status of Canada as a mineral producing country would be increased tenfold, and to add that, with proper legislation, many industries now apparently dead would be flourishing. Why, for instance, should our iron beds remain idle? Oh! people will say, there is no fuel. Yet here we have at our door, limitless quantities of splendid peat which, at a cost not exceeding one dollar per ton, according to Mr. D. Aikman, can be manufactured into a compressed fuel equal, for many purposes of iron manufacture, to any imported bituminous coal, while for the puddling and refining process we have, in the basin of the St. Lawrence, natural gas as yet practically untested, although from the efforts made in this direction sufficient has been ascertained to warrant the expenditure of a certain amount of money in its search. The importance of this fuel peat, not only for domestic use, but for various processes of manufacture, including that of iron, has been already pointed out by Dr. T. Sterry Hunt in various reports to the Geological Survey. But if we have not in Ontario and Quebec the necessary fuel in the shape of raw coal directly to hand, certainly, if it is profitable to the iron smelters of the United States to carry raw ores from western Lake Superior and Canada for their furnaces, it should be equally as profitable on this side, and even more so, in the face of the duties imposed on raw material, to import a certain amount of raw coal or coke for smelting purposes in our own country, while from the enormous forests of hardwood which everywhere cover our Laurentian hills and our other mountain ranges an unlimited supply of the best charcoal can be obtained at a very low rate. Under such conditions, and in consideration of the protection afforded the industry by the Federal Government, it does appear only reasonable that the smelting of our iron ores, which occur in such enormous quantities, should receive far more consideration than has yet been bestowed upon this important element of our national advancement.

That our gold fields are rich beyond those of most countries may not be generally known, but that there is an abundance of gold in certain portions of the eastern counties of Quebec, sufficient, if properly worked and under proper scientific methods, to pay handsome dividends, either by washing the gravel, or by the process of crushing the quartz up, is a fact that cannot, in the face of the evidence before us, be disputed. This industry, however, has never, in so far as can be ascertained, been prosecuted with any regard to an intelligent conception of the conditions existing or the proper methods to be employed.

If the members of the General Mining Association of Quebec should do nothing more than arouse an interest in the proper and scientific development of our mineral resources, it would prove itself worthy of the thanks of the whole Dominion. The land teems with mineral wealth, from the Atlantic to the Pacific. Of several of the most important minerals we have at present practically complete control, viz.: of our asbestos and nickel,

and yet of the former it must be said, so bad has been the system of development and of extraction that the greater part of the mines are now in a positively unsafe condition as regards working. Had there been the proper amount of scientific and technical training on the part of those in charge at the outset, much unnecessary future delay and expense would have been avoided. A society such as this should be able to exercise a very marked influence in different ways; not only in keeping a watchful eye upon legislation which may prove injurious to the general welfare of the mining centres individually, but to the mining interests as a whole, and in having a watchful care over the interests of the men employed—the conditions of whom, for good or ill, depend, in most cases, upon the intelligence and the amount of scientific knowledge possessed by the persons in charge, among whose first interests should be the keeping of the mines themselves, in which these men have to labor, in such a condition of safety that life and limb may not be needlessly imperilled, and in providing for the sanitary condition of these mining centres as well. Some legislation tending in the direction of a proper system of mine inspection by thoroughly competent men, would be of the greatest value at the present time, and would tend to do away with much of the loose methods of work and of the carelessness, the consequences of which we hear from different portions of the mining centres. The formation of local mining clubs also, where items of interest in connection with the different branches of the industry might be discussed, and in the establishment of night schools for the men, and questions of sanitation, etc., are also important ones. These clubs could formulate their ideas in a series of papers to be presented at the regular meetings of the society, and thus a healthy and beneficial interchange of thought and sentiment among all the departments of mining work could be promoted with much profit to all interested.

SIR WILLIAM DAWSON — Before I leave to fill another engagement, I desire to thank you for the privilege of attending this meeting. If any of the members would like to visit our Peter Redpath Museum, I shall be glad to show them round, and do anything for them in my power.

The PRESIDENT expressed his pleasure at the presence of the venerable Principal of McGill at the meeting, and having returned thanks on behalf of the members present for the kind invitation to visit the University, announced that in consequence of the non-arrival of his apparatus from New York, Prof. B. J. Harrington would be unable to read his promised paper on "Assaying by Electrolytic Methods."

PROF. HARRINGTON—Messrs. Eimer & Amend, New York, from whom I purchased the apparatus, faithfully promised to have it sent on for this meeting, but as they have not done so, I must ask you to postpone the subject until another meeting.

MR. E. D. INGALL then read his paper: "The collection of mining information and statistics by the State."

MR. C. CIRCKEL followed with his paper,

Occurrence of Asbestos at Templeton, Que.

Of all the minerals which have been discovered and worked in Canada, none of them have assumed so much economic importance in such a short time as asbestos. The growth of this industry since the discovery of this mineral in the years '77 and '78 in the hills of Thetford, and Coleraine, is seen in the fact that in the first year of mining operations in '78 there were taken out only 50 tons, and in the year '90 about 6,000 tons in that district. But not only here; in many other localities, principally in the west of the Province of Quebec, asbestos has been found to occur, and even sometimes worked. Thus asbestos has been discovered in the Papineau, near St. André, in the Ottawa Valley; Gatineau, Township of Wakefield; and in many places of the Township of Templeton. But in these places, since the discovery of the mineral, no growth of the industry is to be stated like in the Eastern Townships—no work on a large scale has been established yet. From the Templeton district, it is reported that in the year '89 some tons of asbestos were taken out in the Range 8, lots 10 and 11, and the opinion prevailed amongst geologists—according to the Mineral Resources of Canada, '85—that the mining of asbestos in this section of the country was destined to become an industry of some importance. Sufficient studies of the occurrence of the asbestos bearing rock, however, had not been made; the deposits were not accessible, and therefore it was difficult to form an opinion about their extent. Since April last year in the said Range 8, lot 11, some development work has been done with a view to studying those peculiar rocks, and it is the purpose of this paper—so far as investigations have showed—to describe the mode of occurrence in this latter place.

The rock in which the asbestos occurs forms a large strata of massive crystalline limestone of about 700 feet in width, striking in a north-east and south-west direction, confined on both sides to red, grey and white orthoclase gneiss in great variety. Quite pure limestone is seldom met with; for the most part it contains impurities of small crystals of mica, iron pyrites, small veins of graphite and sometimes pockets of hematite in small extent; grains of serpentine are disseminated through the whole massive rock, and serpentine deposits as asbestos bearing rock in their peculiar and strange forms are very numerous. The latter form disconnected lumps, patches or pockets of small extent, from 1 foot up to 3 feet in diameter; irregular masses of limited extent, and round layers with ring or elliptical sections in a diameter of 3 to 50 feet, and with serpentine walls varying from ½ foot up to 3 feet in thickness. The character of this deposit on the surface is for the most part a circle or an ellipse, though in different places straight veins of small extent have been observed. It is remarkable that the round veins are mostly sharp, limited to the inside, while to the outside almost a gradual change in color from serpenttne to limestone is to be seen. These deposits are, in relation to the limestone masses, very numerous; nearly all of them contain asbestos more or less; deposits of small extent bear few laces—seldom asbestos veins of considerable length. Concerning the colours, they are very various; light green, yellow green, dark green, greyish-green; and it is difficult to say which color is characteristic for the occurrence of asbestos. Greyish-green colour is seen very often in deposits of considerable extent, mostly containing small laces of asbestos. Small cracks caused by the mechanical action of water are very numerous, and, therefore, the material splits up very easily and is hard to get in large pieces. On account of this fault, it cannot be used for ornamental purposes. Fresh serpentine contains much water and is easily separable from the asbestos. Some light green varieties are soft and have a peculiar unctuous aspect.

The occurrence of asbestos in these deposits is highly irregular. Laces of ⅛ of an inch increase to veins of 1½ inch in thickness, which continue for a short time and then split up again. Other conspicuous veins of ⅝ to ½ inch in thickness split up in many minute laces of $\frac{1}{20}$ of an inch, come together and form a large vein. These veins are seen sometimes to be displaced out of their natural position, cut off by cracks running, as observed in two places, perpendicular to the strata line; a displacement, however, larger than two feet has not yet been observed. The general direction of all veins is mostly parallel to the limited flats.

In many cases instead of fibrous veins, asbestiform matter of white colour and of the same structure is met with; it has an unctuous aspect and shows occasionally the gradual change to the fibrous variety. Concerning the asbestos itself, the highly silky fibre is adapted very well for spinning; it has a marked wavy lustre, a light yellow, light green or dark green colour, is very transparent as a sign for the absence of impurities. Several chemical analyses have shown that the Templeton asbestos contains very little iron, much less than any other asbestos in Canada. Black-blue varieties, with very nice silky fibre of 1½ to 2 inches, has been observed in only one place in a depth of 60 feet; this occurrence, however, seems to be accidental, supposing that the depth scarcely may have an influence either on the color or on the largeness of the fibre.

Concerning the quantity of these asbestos-serpentine deposits, they are distributed through the whole limestone-strata, and on account of the lack of leading indications it is difficult to say which part of limestone probably can contain a large number of deposits, even when very good surface veins are seen. In one place there were seen on the surface, five round veins 5 to 12 feet diameter, close together, and with very nice asbestos laces of ¼ of an inch up to 1¼ inches, and the opinion prevailed that this place in depth might contain a large quantity of asbestos, or a large number of other asbestos-bearing deposits. Quarry work was started, and besides the above-mentioned deposits, six smaller ones of 3 to 5 feet diameter, in a depth of 40 feet, had been found: four of them did not contain any asbestos, and the other two had small veins. The results of this trial work were unfavorable, in so far as the ratio of the cleaned asbestos to the raised rock was very small. Amongst many other deposits which have been found, there are two remarkable. A large vein, with ellipse surface character, of about 50 feet in larger diameter, with serpentine walls of 2½ to 3 feet, and splendid fibre of ½ to 1½ inches on the surface, showed in a depth of 60 feet the same quality, the same length of fibre and width of the serpentine. In the same depth this vein was followed by drift, and it was stated that it had no larger extent in the horizontal section. the serpentine walls being vertical and regular in occurrence. Close to this vein a great number of serpentine lumps were seen, but the asbestos occurred in the same in few small laces.

Another vein, with ellipse surface character, 40 feet larger diameter, with very nice silky fibre on the surface, had, in a depth of 45 feet, the same width of serpentine and the same length of splendid fibre as observed on the surface.

Most of all the other asbestos-bearing deposits found on the surface or under earth did not show a larger extent than 20 feet. It was often observed that in these deposits asbestos of considerable length occurred on the surface and disappeared by following the vein into the depth. This fact shows evidently that one cannot always rely upon good surface indications in deposits of smaller extent; it shows that it is impossible to make any calculation about the quantity before the vein is opened in different places.

It seems, however, that generally deposits of larger extent, with good fibre on the surface, continue, as observed in two large layers, into the depth, and that these deposits do not show such large irregularities in the occurrence of serpentine and asbestos as such of smaller extent. This observation, and the fact that serpentine layers of considerable extent are found to occur in other limestone stratas of the Township of Templeton, gives us some reason to suppose that extensive profitable mining work can be done, if it is possible to find a certain number of large deposits. and there is all probability that the latter can be found.

As for the origin of those peculiar serpentine layers, it is this—an unsolved problem yet. But when we take into consideration the discovery of *Eozoon Canadense* by Dawson, the careful observations by Gumbel, Hochstetter and Credner, about pre-existence of organic life in the rudimentary crystalline limestone, we have some reason to suppose that these peculiar forms are built up by organic forms—probably by foraminiferes—and that after the death of the animals the cells have been precipitated by silicates of magnesia out of the water of the ocean. Probably the fissures have been caused by shrinking of the serpentine and then filled with asbestiform matter by the activity of water. But this theory must be proved yet by microscopical investigations and it is not the purpose of this paper to enter into discussion about this subject.

MR. W. H. LYNCH, Danville, concluded the session by a few well directed remarks on the subject of the development and wonderful promise of the Kootenai mineral district, British Columbia.

A Highly Successful Dinner.

"Then drill, ye tarriers, drill!
Drill, ye tarriers, drill,
Oh, its work all day without sugar in your tay
Where ye work beyant on the great railway,
And drill, ye tarriers, drill!
Work—and slave— and toil."

Promptly at eight o'clock the members of the Association and their guests filed into the Ladies' Ordinary at the Windsor Hotel, and sat down to an excellent dinner with an appetite all the more keen from a hard day's work. The tables were tastefully decked out with flowers and many colored padella lamps. McQuirk's orchestra supplied the music. Hon. George Irvine presided, having on his right Mayor McShane, and on his left Mr. H. S. Poole, General Manager Acadia Coal Co., Stellarton, N.S. Capt. R. C. Adams occupied the vice-chair, having on his right Prof. B. J. Harrington, and on his left Prof. H. T. Bovey, of the faculties of Applied Science and Civil Engineering of McGill University. Among the other guests present were noticed: Prof. McLeod, Secretary Canadian Society of Civil Engineers, Montreal; Mr. H. S. Budden, Managing Director Intercolonial Coal Co., Montreal; Dr. Robt. Ells and E. D. Ingall, M.E., Ottawa; W. H. Lynch, Danville, Que.; E. Arnoldi, J. Maclaren, J. T. Donald, M.A, etc. Letters of apology were read from the following: Sir William Dawson, Hon. H. Mercier, Rev. Abbé Laflamme, A. Blue, Director of Mines, Toronto; Dr. Selwyn, Ottawa; Hon. E. Dewdney, Ottawa; E. Gilpin, F.G.S., Halifax; T. R. Gue, Halifax; John E. Hardman, S.B., Oldham, N.S.; Dr. Geo. Dawson, Ottawa, and others.

THE PRESIDENT having proposed the usual loyal and patriotic toasts, gave "The President of the United States," and made a kindly reference to our American cousins, through whose energy and enterprise the Dominion was indebted for not a few of its successes in mining ventures.

COL. LUCKE, Sherbrooke, returned thanks for the toast in a brief but graceful speech.

DR. R. W. ELLS, in proposing the "Mining Industries of the Province of Quebec," commented on the remarkakle growth of the mining industries of the Province in recent years, and on the systems of working in vogue at the mines.

HON. GEORGE IRVINE—I am asked to respond to this toast in a sort of a representative capacity as President of this Association. As you well know I am very deeply interested in mining, and I may for that reason say that it is with great sympathy that I respond to its interest. I could not help thinking to-day when I heard our excellent friend Capt. Adams, explaining mining luck, when he told us that ninety-five per cent. of the money put into mines was lost, that there were a good many people belonging to this Association that belonged to the five per cent. who were successful. Gentlemen, I fully appreciate all that has been said by Dr. Ells just now, and by the other gentlemen I have heard to-day, about the importance of a good technical education. Now, gentlemen, any person will see the importance and advantage of that. At the same time I must say, on behalf of men who are not technical men, that I have been interested in mines respecting which technical men have not given good advice. For instance: A friend of mine, who was then living in Quebec—a very energetic engineer—came to me one day and he said: "You are a friend of mine and I would like to give you some advice—you are not working that mine of yours right—I will show you how to do it and you will make very much more money." I said "It is very kind of you." Well, there happened to be also in Quebec at that time a man who was acknowledged to be one of the most eminent mining engineers in the Province of Quebec, and I told him what the man had said. He examined the mine very carefully and he came back to Quebec and said, "You have been working that mine for five or six years at a profit." I said "Yes." He replied: "Go on as you have done; you have done very well." (Laughter.) That was on the technical, but we have gone on on the practical advice since and we have had a very fair share of success. I simply mean to say by this that with luck it is quite possible to go on as we have done. Gentlemen, I thank you for the appreciation you have shown to mining interests in which you are all concerned yourselves.

Mr. S. P. Franchot and Mr. D. A. Brown also responded.

MAYOR MCSHANE—With your kind permission I beg to propose a toast, and again with your permission I beg to tell you a little story. There are no ladies present. (Oh!) It is not a naughty story. (Oh!) It is simply this gentlemen: A few years ago I was at a school examination and the class was examined by the different professors and the last question put to the boys was this: "Who was Moses?" All the little boys snapped their fingers, and one little fellow by the name of Jack McLynn said "I know it, I know it," and the professor said, "Well, who was Moses?" Jack McLynn said "He was Pharoah's eldest daughter's son." The professor said "Not at all, Moses was found in a basket in the bulrushes." The boy said "Oh, no! *that was what she said.*" (Laughter and cries of "Oh, Jimmy.")

Before I propose the toast, I desire to say, that as Mayor of the City of Montreal, I am proud of the gentlemen who are mixed up in the mining interests of this country. My friend Captain Adams is a gentleman whom I have known for a long time, and I notice that he has taken a great part, and has given himself a great deal of trouble to develop the mining interests of this country. I had the pleasure the other day with a number of aldermen to visit that grand institution, the Workman Engineering building, which is about to be built up by Montreal gentlemen, whose energy has done and is doing so much for our city. I visited that great building which is soon to be completed, and which will be an institution that nothing will compare with on this side or the other side of the Atlantic. I ask you to drink to the toast, and I have the honor to name your president—a gentleman who for many years has occupied in this great Dominion of ours the highest position that the people can confer upon him—a gentleman whose whole life and associations are with the people; there is not a man living who is more respected by the people than my friend, your president, Mr. Irvine—his talents, his great ability as a lawyer and as a judge have won for him the highest esteem in Admiralty circles, his success as a miner, and his principles of fair play have won for him the respect of all the people of this great Province of Quebec; therefore, gentlemen, I am proud to stand up, as the Mayor of the people—of the citizens—your Mayor (oh), and in the name of the people of Montreal I desire you to drink to the health of your president, my friend, Mr. Irvine. (Loud applause).

The toast having been drunk with "three times three" and all honors, "He's a jolly good fellow," &c.

HON. GEORGE IRVINE—You have received the toast Mayor McShane has proposed with a great deal more enthusiasm than I have deserved. Mr. McShane has spoken flatteringly of me, but you know he is an Irishman, and sometimes given to blarney; (laughter); at any rate Mr. McShane and I have fought in old time, we have fought side by side; sometimes we agreed and sometimes we have disagreed—most times we have agreed, though. He and I fought together to try and put down a great evil in this country, which is corruption in high places; no man can say that the people's Jimmy has ever changed, he will continue to do as he has always done. (Cries of question?) Gentlemen, I thank you very much for the way you have so kindly treated me. I have done the best I could do for the Association, and if I have done any good I am pleased to have done it, and I thank you very much for the kind way you have drunk to my health.

CAPT. ADAMS—I am glad to propose a toast to our schools of Mining and Techinal Education, not that I feel qualified to do justice to the subject, but because I am an enthusiast in mining, and being a Boston man must necessarily be a friend of education. Our worthy Mayor has told you about the birth of Moses, and as we need all the endorsements that we can get for our industry, it may encourage you to know that Moses was the first miner. Mining men are usually religious, and you are doubtless all familiar with the good old hymn, "Could I but stand where Moses stood and view the prospect o'er," showing that our honorable pursuit is of great antiquity, and that Moses was successful in his finds, for he not only went prospecting, but actually saw the ore.

Mining in Canada has too often been done by main strength and stupidness, and I prided myself upon being the first person in the phosphate industry to employ a scientific mining engineer. He made a systematic search for minerals, and built elaborate shafts, but the veins never came together where his science demonstrated they ought to, and at length his shots blew out the underpinning of his well constructed crib work. (Laughter.) I found that an educated engineer might be like some mines; he shows well on the surface but there's nothing in his lower levels. Education means to lead forth, and there must be something in a man to be brought out. Another experiment was more fortunate. I engaged a young doctor of philosophy from Harvard College, who was at first badly snubbed by my "practical" manager, who said "I have seen enough of such fellows, and I don't want any more of them about me." He however eventually became manager of the mine, and is now assistant geologist of the State of Arkansas. (Applause.)

The origin of the name of "Canada" is thus given; The Spaniards visited Canada previous to the French, and finding no gold or silver, which they were in search of, often said among themselves, "Acanada,"—there is nothing here. The French arrived, and the Indians, who did not want their company, and supposed they were also Spaniards on the same mission, were anxious to inform them in the Spanish sentence "Acanada." The French, who knew as little Spanish as the Indians, supposed this incessantly recurring sound was the name of the country, and gave it the name of "Canada." But even if this story is true, its implication is not correct. There is a good deal in Canada, and it will be better utilized when more knowledge is applied to its development. It is said that north of Lake Superior every man owns a mine: poor men have two or three mines, and very poor men have seven or eight mines—the poorer they are the more they have. (Laughter.) Men are impoverished by their riches. We need education to enable us to work these properties economically, to surmount natural difficulties, and to throw off legal shackles. In phosphate we need mechanical or chemical processes for the separation of the ore from impurities; in asbestos we need better systems of cleaning the fibre; in gold we want improved processes to amalgamate the arsenical ores of Madoc, of which forty per cent. are said to be wasted, and it is technical education that will lead to these discoveries.

The phosphate men especially should favor these schools, for is it not said by a German philosopher, "Without phosphorus no thought," and I have come across a parody of an old nursery rhyme:—

"Sing a song of phosphates,
Fibrine in lime,
Four and twenty follicles
In a vein of time,
When the phosphorence
Evoluted brain,
Superstition ended,
Man began to reign."

The asbestos men may pride themselves on the antiquity of the use of their marvellous product, if it be true, as is stated, that the three worthies who survived the scorchings of Nebuchadnezzar's fiery furnace were clothed in asbestos suits. Asbestos miners are largely dependent upon the application of educated intelligence not only in the production of their mineral, but in discoveries of methods of using it.

We are glad to learn that our honored president has "made his pile" in mining, and that our worthy Emerald friend "The Duke of Buckingham," has a bursting pocket book, but if we are not all rich we all expect to be rich, and there is not a miner present who is not on the eve of a great "strike," and who is not sure of being a millionaire in a few years; for as Pope says, or meant to say, "Hope springs eternal in the miner's breast. (Applause.) I wish therefore to let my remarks lead to a practical conclusion. It is very easy for us to give away what we haven't got, and I wish to propose that we should to-night agree that a goodly proportion of the large mining profits that we are all going to make shall be presented to McGill College to endow the branches of mining and chemistry and its science courses so that it shall become the very best school of mining upon this continent. Mr. Chairman I have much pleasure in proposing the toast of "Our Schools of Technical Education." (Loud applause.)

Mr. Wm. Sclater, at this stage, favored the company with his great original melodramatic warble "What will my good old mother say to me."

MR. W. C. CARLYLE, Professor of Mining Engineering at McGill University, in returning thanks, gave some incidents in his mining career in Colorado to illustrate the utility of having a good technical education when combined with a sound practical experience in the actual mining work. He was loath to think that our mining laws were not as they should be, and he was astonished to find that in the Province of Quebec the miner to-day was in doubt as to the security of his title to lands of which he has had possession for many years. He believed that mining property should be for the people and not for the Crown. Every facility should be given to the prospector, the capitalist, and the miner, to engage in mining ventures.

Prof. Bovey and Prof. Harrington also acknowledged the toast on behalf of their respective faculties.

Mr. E. Arnoldi sang with splendid effect "Drill, ye Tarriers, Drill," the company joining with the greatest heartiness in the chorus, and insisting upon an encore.

Mr. H. A. Budden proposed, in a few well chosen sentences, "The Mining Industries of Canada."

Messrs. H. S. Poole replied briefly for Nova Scotia, and W. H. Lynch at some length for British Columbia.

Prof. McQuirk having favored the company with a song, Mr. B. T. A. Bell proposed the toast of kindred societies, to which Prof. Macleod replied for the Canadian Society of Civil Engineers, and Mr. E. D. Ingall for the Logan Club.

Mr. L. A. Klein also acknowledged the toast on behalf of the Asbestos Club. He took some of the speakers at the afternoon session to task for the slur that had been cast on the methods of working the asbestos mines. He claimed that all the mining engineers of the world, and the staff of the Geological Survey combined, could not have opened their quarries in a more systematic or skilful manner then they had been, and he pointed out in support of his contention that there had never been an accident of any consequence except, said he, in the case of "one man who had been blown up by lightning." (Laughter.)

Capt. Adams proposed a bumper to their secretary, Mr. B. T. A. Bell, after which Mr. W. A. Allan concluded the toast list by proposing "The Geological Survey of Canada."

The proceedings terminated shortly after midnight with "Auld Lang Syne" and the National Anthem.

Mazinaw Lake Silver Locality Re-discovered.

The North Hastings *Review* is authority for the report of the re-discovery of a fabled silver cave where, in past years, an old man by the name of Meyers procured rich specimens of native silver. Only the oldest men in Hastings and Frontenac counties remember Meyers or his associates. The last surviver died near Oshawa not many years ago. When he realized that he was on his death bed he sent for a young man, Mr. W. G. Ruttan, and gave him the maps and plans by means of which the famed mine could be found. In 1889, Mr. Ruttan and Mr. Thomas Salter commenced prospecting for the lost mine, which so many had tried to find but without success. A few days ago, a miner employed in the mines being opened on John Perry's farm in the Township of Barrie, found a small opening in the rocks, almost choked up with debris and tangled berry bushes. He cleared away the rubbish and entered a narrow passage which led him into a cave of considerable size. On the walls he found the name of C. Q. Meyers. Several mining tools were found, and with these he procured samples of native silver and ore. A company has been formed in Peterboro' to develop the discovery.

A small vein holding meneghinite was opened on the Perry proverty near Marble Lake during the time of the gold excitement in North Hastings, but native silver has not been reported to have been found in Eastern Ontario, and the *Review* will be pleased to receive samples of the new discovery of native silver.

A Great Electrical Transmission.

The United States Consul-General in Frankfort, in a recent report, describes what he calls the most momentuous experiment in technical electricity ever made since electricity has been rendered serviceable to mankind. The object was to create a current of 200 or 300 horse-power, by a dynamo driven by water-power at Lauffen, on the Neckar, 108 miles south of Frankfort—"convert it into a current of intense pressure, by specially-devised transformers, transmit it to the Frankfort Exhibition, there re-transform it to a current of ordinary pressure, and in that form apply it to motive and lighting purposes." It is said that fully 75 per cent. of the energy created in Lauffen is available in Frankfort. Part of the current thus secured is used to illuminate 1,200 arc lights, while the remainder drives a rotary pump, which draws water from the main and forces it to the top of an artificial hill, when it tumbles as a waterfall on the exhibition grounds. Thus the falling waters of Lauffen, 108 miles away, are reproduced at Frankfort by a current over three delicate copper wires. The apparatus is described by the Consul-General as follows: At Lauffen a Girard turbine wheel of 300 horse-power, under a 12-foot head of water, is coupled directly to a dynamo of the multiple-current or rotation-current type. The turbine makes, at ordinary speed, 30 revolutions per minute, and the dynamo five times that number. This produces a three-phrase rotation current, whose three components have, in technical phrase, "an electro-motive force of 50 volts and 1,400 amperes each, giving an output available for transmission equal to 200 kilowatts." From the generator, strong cables lead to a switchboard provided with the ordinary measuring instruments for current and motive force, and thence into a transformer specially constructed for this purpose. Besides the large dynamo, a continuous-current machine, operated by a special turbine, serves as an exciter for the principal generator. In the transformer the current is converted into one of intensely high pressure and small strength. For the reason that the air is not a component insulator for currents of high intensity, the transformer is immersed in a large, closed tank filled with oil. The converted current, having now a motive force of 1,500 volts at 12 to 13 amperes, is transmitted from Lauffen to Frankfort on three light, naked copper wires, 4 mm. in diameter, strung upon poles 25 feet in height and 190 feet apart. They are hung upon porcelain insulators, each of which is provided with one or more troughs filled with oil. The copper wire conductors necessary for the experiment are 430 miles in length, and weigh 132,000 lbs.

A New Miners' Electric Lamp.—A new miners' safety electric lamp has been invented by Mr. C. N. Gauzantes, a French electrician residing in Cardiff. A primary battery is employed, which consists of a case of tin containing two cells, around the sides of which are placed, four in each cell, vertical slips of carbon; in each cell a zinc rod is suspended from the cover into the generating fluid. Binding screws are fitted to the carbon, and zinc poles for connecting purposes, and the lid is tightly fastened, being to all intents and purposes hermetically sealed. Upon this lid is placed a small incandescent lamp, with its guard and reflector adapted either for diffusing the light horizontally or vertically. In size the lamp is about 4 inches wide, 2 inches broad and nearly 8 inches in height, and easily carried by means of a light handle affixed to the side. The weight of the lamp when fully charged is about 3 lbs. 12 oz., and it gives a surface light equal to ¾ candle power, or ¼ candle in excess of that given by the most powerful safety lamp. The prime cost of construction is only 5s., and the weekly working cost of replenishing the battery is estimated at 5½d., whilst so little wear and tear do the internal parts undergo that the life of the lamp is reckoned to be five years.

Mine Ropes.*

The report on mine ropes in Belgium, England and Germany, made to the French Government by Aquillon, may be thus summarized :

With regard to the material for pit ropes, whether hemp, or iron, or steel wire, and their shape, whether round or flat, the advantages attributed to hemp ropes, of giving warning before they break, is shared equally by wire ropes when properly looked after, and the latter can be employed with as much safety as hemp ropes when proper care is bestowed upon everything affecting their working. In wet pits, particularly where the water is at all corrosive, or where it is wound up in buckets instead of being pumped, aloes ropes are preferable. But in up-cast shafts, however slightly warm be the air-current, wire ropes should be used in spite of the disadvantage of their hemp core. In the absence of any such special reasons the choice of material is more a question of economy and convenience than of safety. Where it is determined that the rope shall be flat instead of round, the power of the winding engine in deep pits can be better balanced with a hemp rope, because a flat wire rope is too thin to alter the leverage quickly enough in coiling or uncoiling on the rope roll, and would involve some kind of counterbalance, which would be a matter of difficulty. This is the practical reason why several deep pits in France have recently changed from flat wire ropes to flat aloes ropes. With wire too, there is much more difficulty in making a good flat rope than a good round one ; and round ropes winding on conical or spiral drums afford a convenient means of balancing the engine power. As to the choice between steel and iron for wire ropes, German and English practice goes to show that steel ropes well made and of a suitable quality of steel, are capable of working better in all respects, and appear even to be safer. The exclusive use of steel wire ropes in Germany and England, and of hemp or aloes ropes in Belgium, for all depths of pit, is attributed to the degree of excellence which has been arrived at in the two former steel-producing countries in the manufacture of steel wire of sufficiently homogeneous quality and otherwise suitable for ropes ; whereas, in Belgium the manufacture of aloes or hemp ropes has always been a special industry of Flanders, where it has attained a rare degree of perfection. The whole of the winding gear should always be carefully adapted to the particular material of which the ropes are made. In France the mistake has generally been committed of ordering a rope without giving the maker any idea of the conditions under which it is to work, the very make being often specified for him in detail. Elsewhere the more sensible practice is to consult with the maker throughout, furnishing him with complete information as to the whole of the requirements to be fulfilled.

In addition to being tested, all ropes should be guaranteed by the makers. In Belgium the guarantee for aloes ropes is generally that they shall last one and one-half to two and one-half years, or else for a given output ; and one-twelfth or one-twenty-fourth of their value is deducted for every month short of their stipulated duration. At the Royal Collieries at Saarbrucken, the ropes, of English crucible cast-steel wire, are guaranteed for six weeks, during which the maker is held liable to replace them if found defective. Testing should apply for hemp and aloes ropes both to the raw material itself and to the spun yarn, as well as to sample lengths of the finished ropes. The twist of the rope and the stitching of a flat rope, should be very uniform, and the rope should not contain more than 20 per cent. of tar,

Iron wire for ropes should be strong, hard, pliable and not galvanized, and should be selected from standard makes. Steel wire should be made from crucible cast-steel of very homogeneous and comparatively hard quality and suitably annealed ; it should have a tensile strength of 70 to 76 tons per square inch, and should stretch three-fifths per cent. and be pliable. It should be tested for tensile strength, stretching, bending and torsion ; and all the wires in the same rope should be as closely alike as possible. Sample lengths of the rope itself should also be tested. The lay of the wires and strands should be regular ; in flat ropes the stretching should be regular and should be done with annealed wire. Torsion is considered an excellent test for homogeneous quality in wire ; steel wires of 0·059 inch and 0·118 inch diameter should stand twisting through 40 and 20 revolutions respectively in an unloaded length of 6 inches, and the surface markings produced by the twisting should follow regular lines.

The size of the wires and length of their lay or pitch in the rope should vary in accordance with the diameter of the drums and pulleys around which the rope will have to work, and particularly with the distance between the drum and the pit head pulley, and with the angle which the inclined span winding on the drum makes with the vertical portion hanging down the pit. These are essential points for determining the stiffness requisite to prevent the rope from flapping as it runs.

Experience proves that the very material itself of every rope does certainly undergo deterioration in working, thereby diminishing the rope's strength till it becomes no longer safe. This deterioration of material is something more than mere wear by friction or rusting. In aloes ropes the fibres lose their strength, and in wire ropes, even where testing fails to show any loss of tensile strength per square inch of section, there is a clear diminution of pliability and elasticity ; the wires become harsh and brittle, whereby the rope is weakened. Though the deterioration is generally accompanied by unmistakable external indications, it is yet desirable to trace its progress by actual tests of the individual wires or of the end of the rope itself.

Large diameters for drums and pulleys are of more importance for wire ropes than for hemp, and for steel than for iron. The smallest diameter should be at least 1,300 to 1,400 times that of the iron wire in a rope, and 2,000 times that of the steel wire. Its relation to the size of the rope itself matters less, because the disadvantage of too small a diameter can be obviated by selecting a suitable size of wire and by a suitable make of rope. It is well, however, for the smallest diameter of pulley or drum to be not less than 80 to 100 times the diameter or thickness of the wire rope, and 50 times for a hemp rope.

The rope should wind smooth on the drums or pulleys, without rubbing sideways against them, and so as to run free from jolts and flapping. For wire ropes it is desirable to line the grooves of the pulleys with wood. The larger the diameter of the head-gear pulley the less does it matter how small be the angle which the inclined span winding on the drum makes with the rope hanging down the pit ; but with smaller diameters of pulley the angle should be increased in order thereby to diminish the bending of the rope in passing over the pulley. Opinions differ as to the minimum angle to be allowed. Some assign 40° as the limit, while according to others it should never be less than 60°. In plan, the obliquity of a round rope between the overhead pulley and the drum should always be kept within the smallest possible limits.

In doubling back the rope end for attaching it to the cage, the loop should be kept as large as possible by inserting within it an iron eye or a wooden disc : this is particularly advisable with iron wire ropes, and still more so with steel. The attachment should also be made with springs for easing the jerk at starting.

Iron or steel wire ropes of large size should not work at more than one-tenth of their breaking strength : small, round ropes may be worked up to one-sixth ; well made aloes ropes may be loaded to one-seventh or one-eighth.

Careful maintenance is indispensable to the preservation of all ropes, especially of wire ropes. Hemp ropes need tallowing regularly, and aloes ropes need to be kept always damped ; wire ropes, steel particularly, should be greased regularly, and often enough to prevent their ever beginning to rust. The grease should be soft enough to work into the strands right through the hemp core, but stiff enough to stick on the outside of the rope. A mixture of oil and grease, well stirred and laid on hot with a brush, answers very well : both oil and grease should be neutral.

Iron wire ropes are rapidly being replaced by steel wire, owing to the less weight needed to afford the same strength. But it must be remembered that when the mine water contains much acid the steel will wear much faster than iron.

The softer kinds of steel, which contain less carbon, approach wrought iron in character, having equal toughness, greater strength and the same capacity of welding. The mildest steel contains 0·15 to 0·4 per cent. of carbon; and the hardst 1·4 to 1·6 per cent The following are the breaking strains per square inch of wire of some of the most usual varieties employed in rope-making, as given by Frechcville :—

Mild steel.....	from	40 to 50	tons.
Best crucible steel.... .	"	50 to 60	"
Best patent steel.....	"	70 to 80	"
Best plough steel.....	"	110 to 120	"

Too great stress cannot be laid upon the necessity of having ropes constructed of the best material. The selection of the material, however, somewhat depends on the conditions of working. Thus, with a perpendicular shaft and large drums and pulleys, a plough steel wire rope will be found the most reliable ; but with small drums and pulleys, and a shaft with angles in it, a rope made of best patent steel, or mild steel, will last longer, as the wires are not so apt to snap in bending. In describing a wire rope, the number of strands, the number of wires in each strand, their gauge, their quality of metal and the material of which the centre or core is composed, should be specified.

As to the gauge, since the ultimate strength of wire increases as its diameter decreases, and since small wires are more pliable than large ones, it would seem that the finer the wire used the better ; but there is a practical limit to this, as very fine wire offers too much surface for oxidation, and is too easily injured by friction. Experience has shown that it is advisable to employ medium-sized wires, between Nos. 10 and 15 of the Birmingham-wire gauge.

For ordinary work hemp cores or centres have been proved the best : they stretch with the strand, allow the wires to bed themselves solidly and give ropes greater flexibility than could be obtained with wire centres.

The latter have not given very satisfactory results in practice, although a greater breaking strain is obtained with a relatively smaller rope.

There are many modifications in the methods of laying or twisting the wires.

Common laid rope often has six strands, with seven wires in each, the size of the wires being altered to suit the size of the rope. Compound ropes (that is ropes with more wires in the strands than the usual construction, in addition to other varieties) have six strands with nineteen equal-sized wires in each, or seven strands, with six wires of about fifteen gauge in the middle and twelve around the outside, alternately fifteen gauge and twelve : ropes with six strands of eleven, twelve and thirteen wires each are frequently manufactured. Some makers prefer the inner wires of each strand smaller, so as to be more flexible than the outer. Six strands in a rope are better than four or five, as they make it more cylindrical, and consequently the friction is better distributed. Six strands of nineteen wires each make very durable ropes : these work better than one of equal size composed of six or seven wires in a strand, as the latter being larger and less pliable are more liable to snap in bending around pulleys and drums. When three or four of these large wires break near together the rope is hardly fit for work, whereas the breakage of that number of small wires would be of much less consequence. More material can be got into the same size rope when compound instead of common laid, as the smaller wires do not leave so much space between.

On account of the many different varieties of steel wire employed in the manufacture of ropes, and the varying size of the hemp centres, and the empty spaces above referred to, it is impossible to state a formula for determining the dimensions of a steel wire rope required to bear a given strain. As the nature of a wire rope, however, is defined by number and size of the wires, it is easy, if we know the section and weight per fathom of the gauge employed, to determine the effective sectional area of the rope and its weight per fathom. Given, then, the quality of the metal, the breaking strain of the rope can be approximately estimated.

The following table by Frecheville, in which the numbers of the Birmingham wire gauge most usually employed in the construction of mine rope are compared with inches, and the weight of a cubic foot of steel is taken at 487 lbs., will be found useful in these calculations :—

No. B. W. G.	Diameter in Inches.	Sectional Area in Sq. Inches.	Weight per Fathom, Lbs.
10	·137	·01474	·2990
11	·125	·01227	·2489
12	·109	·00933	·1893
13	·095	·00708	·1436
14	·083	·00541	·1097
15	·072	·00407	·0825

Thus, in the case of a steel wire rope composed of six strands, seven wires in each, of ten gauge, the effective sectional area will be 6 x 7 x ·01474 = ·61908 square inches, and its weight per fathom in metal, 6 x 7 x ·2990 = 12·55 lbs. If best plough steel wire, with a breaking strain of 120 tons per square inch, was employed in its manufacture, then ·61908, the effective sectional area x 120 tons = 74·28 tons, and deducting one-eighth for lay we obtain 65 tons as about the breaking strain of the rope.

Again, let us suppose a compound rope made of the best patent steel wire, with a breaking strain of 75 tons per square inch, and composed of six strands of nineteen wires each, thirteen gauge. The following calculation—6 x 19 x ·00708, sectional area of each wire, x 75 tons, breaking strain per square inch of wire, less one eighth for lay, gives 52·97 tons as the approximate breaking strain of the rope. Such a rope, with hemp core and fairly made, would weigh about 18 lbs. per fathom, and have a circumference of about 4½ inches. The actual breaking strain, however, can only be found out by testing sample lengths of the finished ropes.

As the operations of manufacture introduce so many elements of uncertainty in wire ropes, it is well to allow a wide margin of safety, especially where their breakage would endanger life, and take the working load as one-tenth of the ultimate strength or breaking strain. The weight of the rope hanging over the pulley at the poppet-heads is, of course, included in the working load. In very deep mines this weight, even with steel wire ropes, becomes a matter of such serious consideration that tapering ropes have to be used. In case of a rope working at a very slow speed, such, for instance, as a capstan rope, a larger factor of safety than one-tenth may be adopted. Since any extra strain on a rope leaves it weaker than it was before, on no account should a rope used for raising men be ever worked above its fair working load. In drawing mineral in Cornwall, the custom is to let the skip down on a "gate" put across the shaft. Probably the greatest strain the rope has to bear is when the full skip is lifted. Experiments made at some coal mines prove that when the full cage is lifted from the bottom about double the ordinary strain due to the load is produced. This arises from the inertia of the mass to be moved. In the case of a skip resting on a "gate," the more slack chain there is the greater will be the strain on the rope at starting.

In winding men there should be no resting-place for the cage : the engine should be started gently, driven regularly, and with a speed of about two-thirds of what is otherwise usual. The rope should also he examined every twenty-four hours, and this should be done by winding it slowly through the operator's hands : if he does not happen to see the broken wires in all probability he will feel them. Occasionally the rope should be thoroughly cleaned, and its condition more minutely ascertained. When broken wires are found, the longest may be tucked underneath and the others cut off, to prevent their catching and doing further mischief. A new rope should be tested every several days' winding before men's lives are trusted to it.

It is indispensable for the preservation of steel wire ropes that they should be greased regularly. The grease used should be perfectly free from acid, and soft enough to work into the strands right through to the hemp core. It must not be of such a nature as to harden, for in that

* From Report of the Secretary for Mines for Victoria during the year 1890.

condition it allows rust to form between it and the wire, so that a rope that appears to be well greased may be corroded to a sensible depth. A mixture of Stockholm or Archangel tar, a vegetable oil, and a little lime boiled together is often recommended. In Cornwall the tar is generally mixed with tallow. These mixtures, however, form too stiff a grease, tend to hide defects, and render the thorough examination of the rope difficult. A mixture containing gas tar is still more objectionable. Of all the lubricants for wire ropes the best is mineral oil. Some of the heavy mineral oils, such, for instance, as the Russian (their specific gravity being higher than the American) possess sufficient viscosity to be used as a lubricant for wire ropes, and will, if tried, owing to their freedom from acid and power of resisting decomposition, be found to give satisfactory results. At the Wearmouth Colliery they have a patented apparatus, consisting of a pair of wire brushes for cleaning the ropes, and a pair of strong hair brushes fed with lubricant from feeders above, for oiling them. Both sets of brushes revolve, being actuated by the travelling rope. It is claimed that this arrangement lubricates very thoroughly, and effects a great saving of oil and labor.

When a rope is used for winding men, the shackle must be cut off regularly every two to three months, the rope thoroughly examined and the shackle reset. This is a point of vital importance for wire ropes. In order to arrive at economical results with wire ropes, accurate accounts should be kept of their working. By this means the kind most suitable may be ascertained, and a considerable saving effected by using an article best adapted for the purpose. However well a rope may seem to be lasting, it should always be suspected as soon as its duration approaches the average that corresponds with the conditions under which it is working. It should, at any rate, cease to be used where human life depends on it. Owing to trade competition there is great danger of inferior metal being used in the manufacture of ropes, so that when a new one is required only the best makers should be applied to, and they should be furnished with full information as to the conditions under which it has to work. There can be no greater false economy than choosing a cheap rope. When a rope is for the purpose of winding men it should be advisable to have a sample piece of it (say a length of ten or twelve feet) tested before use, in order to see that the quality of the metal and the breaking strain are as represented.

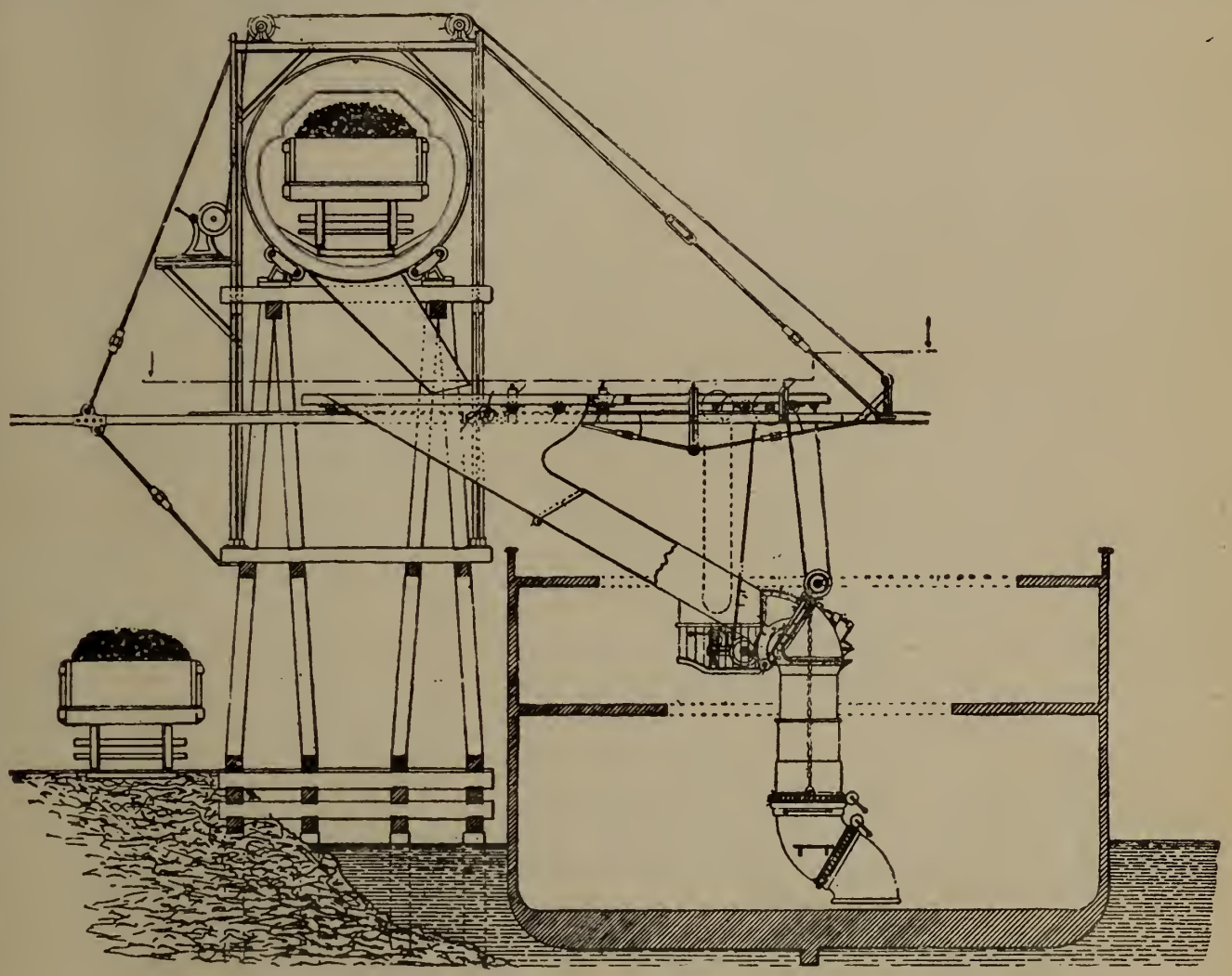
Coal Handling Apparatus.

The success of most inventions hinges on their simplicity—that is, the most valuable machine is the one that does the work with the least possible expense. The simplest way to empty a bucket of coal is to turn it upside down. There has been building for some time in the shops of the Cleveland Ship Building Company a machine for handling coal that embodies that simple principle—it turns the car upside down. There is plenty of work for coal handling machines on the lakes, as 3,107,816 tons of soft coal was shipped from Ohio ports alone last season. No big claims are made for this machine, illustrated herewith, but it is geared to turn over in two minutes. If it turns in three minutes it will do all that is expected, and even if five minutes were required, that would insure the largest vessels getting cargoes in from eight to nine hours, whereas two days is now considered good time for placing coal cargoes aboard the larger steamers. Following is a brief description of the apparatus.

Upon a trestle of suitable height is mounted a cylindrical crib which is so constructed as to be rotated upon its longitudinal axis. Within the crib is a section of track mounted upon heavy jack-screws by means of which a car may be raised and clamped against a series of bolts projecting over the top of the car body. Heavy clamps extending the length of the crib are then brought into adjustment against the side stakes, thus rigidly securing the car within the cylinder. The upper portion of the crib is provided with a number of yokes which forms tue ways for a series of sliding shutters and at the same time carry a pair of steel plates, which with the shutters serves as a roof or a cover for the coal, holding it in position until the car is inverted, when by drawing the shutters the entire load drops in a mass to a fixed hopper immediately beneath. The power required for the various operations is obtained from a small engine elevated conveniently on a frame work at one end of the cylinder, and is transmitted to the various shafts by a novel arrangement of gearing.

Under the fixed hopper referred to is arranged a chute provided with adjustments by means of which the discharge end can be lowered to the bottom of a vessel and be then operated over a wide range for trimming the cargo. By means of a valve of peculiar construction at the lower end of the chute the flow of the coal is kept under perfect control, and the hopper and chute being kept full, the fall and consequent breakage is reduced to a minimum. In the plant now under construction the cars will be raised to the level of the machine by means of an incline and haulage engine, and passing through the machine will run down an incline by gravity at the opposite end of the trestle.

The Lindsley Terminal Equipment Company, owners and operators of the patent, already have the assurance of a large amount of tonnage for the coming season and are pushing their construction as rapidly as possible in anticipation of further requirements in the near future.



Coal Handling Apparatus.

Fires on Coal-Laden Ships.—The destruction of the Carr Rock by fire and explosions, renews the subject which a Royal Commission was appointed to entertain, and the remedy suggested by that body of experts for preventing spontaneous combustion of coal was supposed to have been found and the perils finally disposed of. The Commission recommended surface ventilation and denounced the insertion of pipes through the cargo, or alleys amidships, or any other device for percolating air under or into the mass. With this object it was proposed to let air down one ventilator and exhaust it by another. By this means it was anticipated that cold air would pass on to the top of the coal, but never penetrate the solid cargo to supply oxygen, and to assist in generating conflagration. Ships laden with coal at ports in the United Kingdom are required to comply with the suggestions of the Royal Commission, and the Carr Rock had the regulation ventilation tubes carried through the upper deck with cowl heads, and at the enquiry held at Glasgow into the loss of the ship it is not said that the uprights were washed away. The Carr Rock sailed from Dundee for San Francisco on the 25th of June, with coal hewn from the pits at Barracluith and Ferniegar. The colliery manager stated that the coal showed a great immunity from liability to spontaneous combustion; and pyrites were carefully picked out by the hand as the coals passed over a screen. The inspector of mines said that there was very little firedamp in the mines from which the coals were taken, and the pits were fairly dry, and during his experience he had never known a fire originating from spontaneous combustion in either. If, however, said the inspector, the coal was badly smashed up in loading, there would be a tendency to spontaneous combustion. The ship had been out of port over two months, when she fired and sank. This was quite long enough to warm the coal from the heat of the sun in the hatchways, and to break up some of the blocks by pressure and the rolling of the vessel. Newly-banked coal, as a rule, contains gas, and the quicker it is shipped the less must be the chances of its escape. Gas also escapes from coal when it is broken, and consequently there is always a presence of gas in the holds. The longer a ship is at sea the greater must be the danger from firing. The Carr Rock had fore-and-aft shifting boards, and these would add fuel for kindling and sustaining conflagration. — *Colliery Guardian.*

Experiments with a Compound Winding Engine at the Skalley Colliery, Saarbrucken.—In a paper contributed to *Zeitschrift fur dar Berg, Hutten, und Salinen Wesen* it is said: This compouund engine was originally a single 43·3 inch cylinder winding engine, 61·8 inch stroke, winding two full tubs, of 10 cwt. each, from a depth of 186 fathoms, with a pressure of 44·12 lbs. per square inch. It was compounded to suit an increased steam pressure of 95½ lbs. per square inch, by adding a second cylinder, 31½ inches diameter. The engine now winds four tubs at a time on two decks, there being a counterbalance rope under the cages weighing 8.06 lbs. per yard. The whole winding is done in 40 seconds, at an average speed of 27·89 feet per second, the average piston speed being 4·95 feet per second. In order to show the advantage of the compound system, the author gives, together with the experiments on this engine, tables of results from other winding engines, which show that the gross fuel consumption per hour per useful horse power was 7.31 lbs. for the compound engine, and 11.88 lbs. for a double cylinder ordinary winding engine at the same colliery.

A Feat in Engineering has just been accomplished at the works of the Great Eastern Railway Company at Stratford, London. They have built up a locomotive and tender in ten working hours. Of course, all the parts were prepared, but this time for erecting and riveting is unprecedented. Four years ago at the London and North-Western works, at Crew, 25½ hours was the time taken, and that was considered very good. The engine built at Stratford, too, is of good size. It has three pairs or coupled wheels, each 4 feet 11 inches diameter, while under the tender there are six wheels. The weight of the engine is 37 tons, and of the tender 30 tons. Eighty-five men were engaged erecting the engine, and 52 working at the tender. It is a favorite type of engine, there being in the service of the company 200. The great speed with which the engine was built indicates that every part must have been most exactly made to gauge and measurement.

Plasticity of Clays.—According to Seger (*Thonindustrie Zeitung*) very refractory clays are not able to stand the chemical action of attacking substances as well as other clays of only medium fire-resisting quality, but of greater plasticity. These latter clays, in consequence of this property, set together quicker into the form of a hard fire-brick-like mass. The author gives examples in proof of this statement.

MINING NOTES.

[From Our Own Correspondents.]

Nova Scotia.

Cape Breton.

Sydney and Louisburg Collieries.—At the Reserve mines the slopes were driven down during the winter for another lift, and levels opened out.

At the Emery Colliery considerable work was done during the summer in driving the leads and opening out the mine for a large output. It was at the Emery Mine that the Seargent coal-cutting machine was tried in July, with such favorable results that three coal companies decided to put in plants.

The Sydney & Louisburg Company headed the list of shipping from Cape Breton, with 154,000 tons.

Gowrie Mines.—Shipping was carried on from these mines every month of the year, which speaks well for Cow Bay as a winter port. During the year new rails were laid from the pit to the wharf, and the railway put in thorough order. An air compressor plant of the Ingersoll Rock Drill Co. of Canada, was put in operation to supply and operate the pumps with compressed air instead of steam. The ordinary level work was done to keep the mine opened out for its full capacity, and the west level driven through the fault, and the coal proven on the other side of the upthrow, and found to be of good quality and high. Gourie Mines shipped 152,500 tons. The coke ovens were kept running all the year, and the whole of the coke shipped to the copper mines of Newfoundland. The deeps are to be driven down this winter a distance of 900 feet, to open up a new lift for the coming season.

Caledonia Mines.—The deeps were driven down for two landings; a new bank head made, and a Jenckes underground hoisting engine erected and put in running order, and a greater part of the coal shipped during the summer came out of the new deeps. A contract was made with the Ingersoll Rock Drill Co. of Canada to put in one of their 24 x 30 inch air compressors to run their underground pumps and eight Seargent coal-cutting machines. Caledonia shipped 145,000 tons.

International Coal Co.—At this mine a new ventilating shaft, 90 feet deep, was put down from the surface to the harbour seam, and an 8-foot Murphy ventilating fan erected, which can either be used as a blower fan, or as an exhaust. It has a capacity of 80,000 cubic feet of air per minute, and is driven by a straight-line Jenckes engine, 10 x 12 inch cylinder, and runs 2 to 1 with a 10-inch, 5-ply belt. The foundations of both the fan and engine were made of concrete and put up in a very substantial manner. This company also put on their railway, two new Forney extension engines, built by the Rhode Island Locomotive Works,. Providence—one 60 tons weight and the other 30; built 25 6-ton cars, and added 40 10-ton coal cars of a new and improved type, which were designed by Mr. McLennan, the managing director. They also added one first-class and one second-class and smoker passenger cars, and a combined flanger and freight car, and put in two miles of new rails, and put their railway in first-class condition.

Little Glace Bay Mining Co.—At this mine they are making a great many improvements. A new hoisting engine was received from Messrs. Matheson & Co., New Glasgow, and is now being erected. A new set of 9-inch pumps from the Jenckes Machine Co., Sherbrooke, Que., is being put in place, and a new 8-foot Murphy ventilating fan was erected and started to run. They are now preparing to drive the deeps and levels and open up a large section of coal to the dip of their Stirling shaft, which will give them a large quantity of coal at their command, and will enable them to increase their output at any time 50 per cent. They have also added a new block to the entrance of their harbour, which will give them an additional width of 25 feet.

Gardener Mines.—The Messrs. Burchell pumped out this mine, which they took in hand last October; erected the necessary heap-stead and screens; cleaned out their levels and put the mine in first-rate working order, and in the face of a great many trials and difficulties had quite a considerable output. They also erected and put in a Jefferey electric coal-cutting plant, from which they are getting very satisfactory results.

Old Bridgeport.—This mine sold the whole output of their coal to the International Coal Co., who shipped it at their pier in Sydney Harbour.

Pictou County.

Latest advices report the 6-foot seam at the Vale working half time; Black Diamond, half time; Acadia, full time; Drummond, four to five days per week.

The English slope, which has been standing idle for the last couple of years, and had reached a depth of 1,800 feet when work was stopped, has lately been re-opened, and operations are now being carried on with a view to connecting it with the Foord pit. A drift of some four or five hundred feet will make the connection and give a good air-way.

Cumberland County.

Improvements involving an expenditure af $79,000 have been made at the Springhill collieries within the past six months. To keep pace with the immense quantity of coal hoisted daily, it is necessary to be continually extending the underground workings. As the pits get deeper and deeper, ventilation becomes more difficult. At present the current of air that supports life beneath the ground is forced down by three fans. In order to increase the capacity of the fans and give a circulation of air at the working faces, the air-ways or slopes used exclusively for ventilating purposes have all been enlarged. There are three of these, and at two the area has been doubled. This is most expensive work. At No. 2 slope an experiment was tried. Hitherto all the pits have been timbered with wood, but having a quantity of old steel rails on hand, the manager had them cut into suitable lengths and used instead of booms. Of course the improved steel booms are supported by props of wood in the usual way. The manager says that the experiment has proved entirely satisfactory. All the slopes have been sunk this season with a view to an increased output at an early date. No. 2 slope has been sunk 1,000 feet, making a total depth of 3,000 feet. But no coal will be hoisted from this depth for about a year. At present 600 tons are hoisted daily from the 1,900-foot level. At this slope a new tipple has been erected, being 360 feet long, 30 feet wide, increasing to 42 feet at the screens. It is constructed on a strong trestlework 30 feet high, and the 12-foot post of the building gives a total height of 42 fect. From the pit's mouth to the screens there are five tracks of steel rails, 40 lbs. to the yard. The loaded boxes will run by gravitation to the screens, and the empty boxes return by means of an endless chain, over two elevated tracks. The screens are 54 feet long and 5 wide, fitted with longitudinal bars 15 feet long. Two of the coal chutes are arranged for loading closed box cars. The facilities provided at the slope for handling a large quantity will enable the company to greatly increase their shipment when they begin to hoist from the deep workings.

New Brunswick.

The mining outlook in this Province is, at present writing, rather quiet.

Since the coming into operstion of the new mining Act, quite a few applications for rights of search, prospecting licenses, etc., have been entered upon the books at the Mines Department in Fredericton. As yet very few of the applicants have made any actual start at development, making matters look as if they were simply holding the areas for speculative purposes. In some parts of the Province, however, work is quietly going on, but with what actual results I am unable to say.

Near Woodstock operations are being prosecuted at the Britton silver mine, and it is said the outlook is encouraging.

Work of prospecting, testing, etc., has been energetically pushed at St. Stephen, on the supposed nickel beds, but whether from lack of capital and good judgment or from the fact that the nickel is not in sufficient quantity in the ore, there seems to be no decided boom. One fault, perhaps, is, that these deposits fell into the hands of parties who ask heavy prices for what are practically undeveloped areas, consequently capital is kept at a distance. It seems a pity this field cannot be opened up properly, with necessary capital, as many who have seen locality and ore pronounce it a second Sudbury. It may, however, fall far short of it on actual development, but the chances for a good working mine seem wonderfully good.

In Gloucester County considerable work is being done on silver and gold areas, and it is said some deposits not far from Bathurst are showing wonderfully good results, and may lead to the formation of a first-class company for the working of the mines in this vicinity.

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Halifax, N.S.

It is understood quietly that an attempt may be made during the ensuing year to re-open the antimony mine in Prince William, York County. If so, and they have capital behind them, and are worked systematically, judiciously and economically, good results will certainly follow as the ore is there in paying quantity, if produced and sent to proper markets.

There are numberless other little booms in the mineral line which are as yet not fully organized.

Some St. John capitalists, on a small scale, have gone into two ventures in gold mines in Guysboro' County, N.S. We trust they may be fully successful.

The writer of these notes has had the pleasure of examining closely deposits of splendid ochres in good colors; umber, equal to the best Turkish imported umber; siennas, raw and burnt, which cannot be surpassed in quality; selenite, or rock gypsum, clear and as transparent as window glass, and in abundant quantity; and finally, a natural deposit of marl and shell, in bed of a lake, which is, in itself, if prepared for the market, one of the best fertilizers and natural plant foods for house and garden flowers in Canada. These all occur in Nova Scotia, and are open for negotiation on any fair or reasonable terms, and facts can be obtained from your correspondent, which are reliable and can be depended on fully, by applying to the Review.

It is rumoured—but how correct I cannot say—that many changes will take place in the mining laws of New Brunswick at the next session of the House. Certainly the mining law as it now stands is very rambling, and too technical altogether. Some more suitable and concise laws would have answered the same purpose, and it is thought that the abandonment of all royalties, say for a term of ten years at least, would be more conducive to the chances of capital from outside being employed in our mining industries. It is to be hoped the matter will come up more fully for consideration, and that some amendment may be made which will attract the attention of the capitalists from the United States and Great Britain.

It is to be hoped that the tide of capital which has been flowing into the United States for years past, in mining properties—syndicates of various kinds—may be, or a portion of it, directed into Canadian channels during the next year; and if so, we have no fear but that the Maritime Provinces will receive a fair amount of attention at the hands of such investors; and that New Brunswick, though to all intents and purposes a new comer in the mining field, may be among the provinces to benefit thereby is the sincere wish of yours, etc., Crystal.

British Columbia.

Mr. J. E. R. Ellis, M.E., writing from Nelson, says: There is two to three feet of snow on Toad mountain, and a few inches on the shore of the lake, so that prospecting has been at an end for some weeks past, and the only news of importance to be chronicled for several months to come will proceed from the mines, where active work is to be carried on. Good progress is being made at Pilot Bay, the site of the new lead smelter. Hot Springs camp should consequently make a good showing in 1892. A. B. Hendryx, one of the owners of the new plant, paid us a hasty visit last week. The contract for the iron work of the smelter has been awarded to the Chicago Iron Works.

Dandy.—The main vein on this property has been tapped in the crosscut tunnel, and shows a width of two feet three inches. The ore is similar in character to that found on surface, but for professional reasons I am not at liberty to disclose the grade of the ore. It was the opinion of some that, as depth was attained, the galena seen on and near surface would disappear and be replaced by copper-silver bearing minerals, but at the depth now attained the galena is present in as large quantity as ever. The men are now drifting both east and west on the ledge; 15 to 16 feet have been made in either direction. Mr. Esler has been expected in for several weeks, but has not yet arrived.

Grizzly Bear.—Work is being done on the same lines as hitherto, the tunnel is now in 200 feet, and the crosscut towards the ledge 21 feet. The ore has not yet been reached.

Silver King.—Some ten men are at work, and probably will continue all the winter; but no important results are announced. It is the general opinion that nothing of consequence will be done until the Ramsay interest secure the whole of the property; yet the near future of this camd depends in a great measure upon the results or amount of work done on the Silver King.

Sundown.—The owners have started a tunnel on the ledge lower down the hill than the old tunnel, and propose to push it 100 feet during the winter. Some 25 feet have already been made with very encouraging results; the ledge is 4 to 5 feet wide with well defined walls, and shows 2 feet 6 inches of good ore. The ore, consisting of iron pyrites in streaks and patches, in a gangue of hard, milky ribbed quartz, frequently assays high, e.g.: $258, $203, $83, $92 in gold per ton. The claim is 3 miles southwest from Nelson.

Evening.—A couple of men are pushing forward the tunnel on the Evening, but owing to sickness little progress has been made, and nothing new nas been developed.

Slocan Camp.—The recent discoveries are still the topic of discussion, and sales of bonds with cash payments have already been made to parties who have never seen the district. Enquiries, too, are pouring in from the Eastern states from men who propose to pay the Slocan a visit in the early spring. Many prospectors are wintering near the lake, and a general store has been started there by Hunter & Co., of Nelson. Among others, Mr. Shoemaker, of Butte, and Mr. Hutchinson, are here; the latter has paid $1.000 for the privilege of holding the "Washington" and "G.W.R." claims till summer, while the former—who is said to be working for Marcus Daly—left Nelson for the Slocan a couple of days ago. As a proof of the excitement prevailing, some of the parties who left Ainsworth recently took brooms with them, so that the inspection of the ledges should not be impeded by the snow which now covers everything. The trail from the Kootenai and Columbia Railway, near Ward's Ferry, up the Slocan river, is nearing completion, and the same is true of the route from Kaslo City on the Kootenai lake. The Slocan ore is high grade, and the district is well worthy of attention in the spring, but a heavy discount must be allowed on the statements made as to the size of the ledges and the amount of ore actually in sight.

Lizzie C.—Three men are at work runuing a cross-cut tunnel to tap the ledge at a depth of over 100 feet. The ore which will not be reached for some time to come, consists of fine-grained galena, with some zinc blende and small quantities of argentiferous tetrahedrite, in a hard vitreous quartz gangue, more or less charged with chloritic minerals. The claim lies near the contact of the granite and diabase-schist, three miles south-easterly from Nelson.

Hot Springs Camp.—But little news has reached us of late from this camp. Men are at work on the "Skyline," "Krao," "Tenderfoot," and other properties; the "United" and "No. 1." The machinery which has just been placed on the "Tenderfoot" is the most powerful yet brought into the camp, consisting of a 35-horse power boiler, a 20-horse power engine, and a No. 7 Knowles' pump, with the requisite appliance for sinking 450 feet. The machinery was supplied by the John Doty Company, of Toronto, and, while undoubtedly strong, does not possess that finish and elegance which American mining engineers have become accustomed to The new shaft on the Tenderfoot is now down about 70 feet, but, having recently reported upon the property to the owners, I am not at liberty to discuss its merits.

The year 1892 should be a lively year for the Hot Springs, seeing that the end of the summer will, in all probability, see the new smelter in full blast. Difficulties there are, of course, e. g., supply of good and cheap fuel, disposal of the lead, etc.; but the enterprise is in able hands, and will not fail from lack of forethought or from want of capital.

CANADIAN COMPANIES.

Silver Queen Mining Company (Ltd.)—Application will be made to the British Columbia Legislature for the incorporation of the above company to purchase and carry on mining on the "Silver Queen Mining Claim," located on Toad Mountain, Kootenai District, B.C.; head office, Victoria. Capital stock, $1,000,000, in one million shares of one dollar each. Applicants, Joseph Edward Bass, Spokane, Wash.; William Dally and Fred J. Claxton, both of Victoria; J. M. Lefevre, M.D., Vancouver; Hugh Paton, W. Strachan, Andrew F. Gault, George W. Stephens, Edward L. Bond, Robert Lindsay, Frank. Buller, M.D,, Alex. Robertson, A. C. Clark, John Popham and Samuel H. Ewing, all of Montreal, and Thomas Leeming, New York.

The Neosho Mining Co. (Foreign) has been registered under the British Columbia acts to construct smelting and reduction works for gold, silver or other ores, and to engage in mining, &c. Head office, Ainsworth, B.C. Capital stock, $50,000, in $5,000 shares of $10 each.

The Petit Rocher Silver Mining Co. (Ltd.)—Application will be made to the New Brunswick Legislature for the incorporation of the above company to work mines in the County of Gloucester, N.B. Head office, Petit Rocher, N.B. Capital stock, $25,000, in 5,000 shares of $5 each. The provisional directors are, Jerome Boudreau, teacher; John Morrison, clerk; Joseph F. Comeau, merchant; Frederick Comeau, merchant; Jerome H. Comeau, merchant, and J. A. Langis, surgeon, all of Petit Rocher, Gloucester Co., N.B.

The Gold Rock Mining and Milling Company of Algoma and Nipissing (Ltd.)—Application will be made to the Ontario Legislature for the incorporation of the above company to purchase, lease and work mines and mineral lands, to buy, sell, refine, smelt gold, nickel and other ores and minerals, etc. Head office, Toronto, Ont. Capital stock, $100,000, in 100,000 shares of $1 each. The applicants are, James Beatty, Q.C., Joseph J. Davis, brewer; Elmer S. Townsend, mineral expert; William McCabe, actuary; W. Thomas Newman, mineral expert, all of the City of Toronto.

The Commercial Mining Co. (Ltd.)—Notice is given that the above company will apply for incorporation to the Ontario Legislature with the object of dealing in mining claims in the Province of Ontario, and working and operating mines thereon, and smelting and refining and selling the minerals found thereon. Head office, Toronto. Capital stock, $100,000, in 20,000 shares of $5 each. The first directors of the company are: Wm. Lawrence Borstleman, New York; Frank Edward Shearman, manufacturer, Jamestown, N.Y.; Charles Arthur Murrle, merchant, Toronto; Arthur Harrison Hilyard, salesman, St. John, N.B.; John William Cheeseworth, merchant, Toronto; William Henry Cooper, agent, Toronto; John Charles Prickett, Boston, Mass.

The Nova Scotia Steel and Forge Co. (Ltd.) of New Glasgow, N.S., give notice that application will be made to the Parliament of Canada to confirm certain powers granted to the Nova Scotia Steel Company (Ltd.) viz: To reduce the original shares, increase the capital stock, extend the powers, and to change the name of the company to the first mentioned title; to authorize the new company to divide their stock into preferred and ordinary shares.

Canadian Companies.

The following is a list of the companies incorporated under the various Joint Stock Companies Acts, and also private concerns, for the pursuit of mining and kindred industries in 1891, together with the capital stock and chief places of business:—

Name of Company.	Capital Stock.	Head Office.
Nova Scotia.		
Atlantic Stone Co.	$ 30,000	Lower Cove.
Canada Coal Co.	50,000	Joggins.
Canadian Smelting & Refining Co.	100,000	Yarmouth.
Evangeline Mines Co.	£ 35,000	Windsor.
International Mining and Transportation Co.	$ 100,000	Sydney.
Lunenburg Iron Co.	10,000	Lunenburg.
Mabou Gypsum Co.	25,000	Inverness.
Nova Scotia Mining, Mineral and Transportation Co.	500,000	Louisburg.
Pictou Charcoal Iron Co.	200,000	New Glasgow.
Royal Gold Mining Co.	50,000	Whiteburn.
Torbrooke Iron Co.	100,000	Halifax.
Victoria Gypsum Mining & Manufacturing Co.	100,000	Halifax.
Wentworth Gypsum Co.	200,000	Windsor.
West Waverley Gold Co.	60,000	Waverley.
New Brunswick.		
McNaughton Gold Mining Co.	16,000	St. John.
New Brunswick Mineral Developing Co.	50,000	"
Provincial Chemical Fertilizer Co.	50,000	"
Newfoundland.		
Newfoundland and Canadian Exploration Trust, (Ltd)	£ 150,000	London, Eng.
The Pyrites Co, (Ltd)	£ 300,000	Pilley's Island.
Quebec.		
Beauce Asbestos Co.	$ 10,000	St. Francis.
Canadian Super - Phosphate Manufacturing Co.	£ 250,000	Buckingham.
*Central Lake Mining Co		"
Coleraine Mining Co.	$ 120,000	Montreal.
De Nederlandsche Phosphaat Maatschappij.	200,000	East Templeton.
Glasgow & Montreal Asbestos Co.	£ 70,000	Black Lake.
La Compagnie des Mines d'or de Mattawa	$ 24,000	Joliette.
Mattawa Mining and Smelting Co.	300,000	New York, N.Y.
Moir Granite Co.	100,000	Stanstead.
MacGregor Lake Phosphate Mining Co.	60,000	Montreal.
Phosphate Milling & Shipping Co	£ 10,000	London, Eng.
Taylor Decarbonized Iron and Manufacturing Co.	$ 150,000	Montreal.
Templeton Asbestos Mining Co.	£ 25,390	East Templeton.
Ontario.		
Badger Silver Mining Co. of Gillies, Ont	$ 250,000	Port Arthur.
Belmont Bessemer Ore Co.	600,000	Toronto.
Belleville Natural Gas and Ore Co.	25,000	Belleville.
Bonanza Nickel Mining Co. of Sudbury	150,000	Toronto.
Canada Chemical Manufacturing Co.	80,000	London.
Canadian Natural Gas Co.	100,000	Sherkston.
Chicago-Algoma Nickel Co.	1,000,000	Sudbury.
Crescent Gold Mining Co. of Marmora	100,000	Malone.
Dunnville Natural Gas Co.	20,000	Dunnville.
Electric Mining Co.	125,000	Ottawa.
Empire Mining Co. of Ontario.	75,000	Toronto.
Essex Moulding Sand Co.	25,000	London.
Farmers' Natural Gas and Oil Co. of Gosfield	100,000	Windsor.
Grimsby Quarry and Transport Co.	20,000	Grimsby.
Guelich Silica Barytic Stone Co.	100,000	Ingersoll.
Lyndhurst Lead Mining Co. of Ontario.	100,000	Lyndhurst.
Mattawin Iron Mining Co	100,000	Kingston.
Mimico Natural Gas Co.	100,000	Toronto.
Mutual Natural Gas Co. of Ontario.	20,000	Welland.
Mycenian Marble Co. of Canada.	100,000	Toronto.
North Shore Nickel Mining Co.	500,000	"
Nickel-Steel Co. of Ontario	1,000,000	"
Ogema Mining and Smelting Co. of District of Thunder Bay.	150,000	Port Arthur.
Ontario Mining Stock Exchange	50,000	Toronto.
Ontario Nickel Mountain Mining Co.	50,000	"
Peterborough and Frontenac Mining Co.	10,000,000	Peterborough.
Sault Ste. Marie Nickel Mining and Contract Co.	45,000	Sault Ste. Marie.
Straight Lake Mining Co.	300,000	Toronto.
Sudbury Nickel Co.	50,000	"
Superior Natural Gas Co. of Ontario.	100,000	Sherkston.
Toronto Granite Co.	45,000	Toronto.
Toronto Mining Association.	3,000	"
Wahnapitae Nickel Co	150,000	"
Manitoba and North-West Territories.		
H. W. McNeill & Co.	50,000	Anthracite.
British Columbia.		
Alberta and British Columbia Exploration Co.	£ 20,000	Victoria.
Carbonate Mountain Mining Co.	$ 100,000	Vancouver.
Deadwood Mining Co.	25,000	Victoria.
Glen Iron Mining Co.	50,000	Kamloops.
Gordon Hydraulic Mining Co.	50,000	Leach River.
Hixon Creek Hydraulic Co	100,000	Quesnellemouth.
International Mining and Milling Co. of British Columbia	500,000	Kettle River.
Jeanette Mining Co	500,000	Ainsworth.
Lanark Consolidated Mining and Smelting Co	200,000	Illecillewaet.
Le Roi Mining and Smelting Co.	2,500,000	Trail.
Liverpool Land and Improvement Co.	500,000	New Westminster.
Malaspina Red Granite Quarry Co.	10,000	Nanaimo.
Montreal and Kootenay Mining Co.	20,000	Montreal,
Nelson Smelting and Mining Co.	500,000	Vancouver.
North Vancouver Land & Improvement Co.	500,000	Nelson.
Port Haney Brick, Tile and Terra Cotta Co.	50,000	New Westminster.
Prevost Island Co.	15,000	Victoria.
Spokane and Great Northern Mining Co.	2,000,000	Spokane, Wash.
Stadacona Silver - Copper Mining Co.	100,000	Victoria.
Steveston Natural Gas & Development Co.	50,000	Vancouver.
Tulameen Improvement & Hydraulic Co.	60,000	New Westminster.
Vancouver Stone-Quarrying, Mining and Transportation Co.	25,000	Vancouver.
Western Canadian Ranching Co.	£ 100,000	Victoria.
Western Consolidated Mining Co	$ 1,000,000	Spokane, Wash.
Westminster Slate Co.	100,000	New Westminster.
West Kootenay Mining Co.	1,000,000	Ainsworth.

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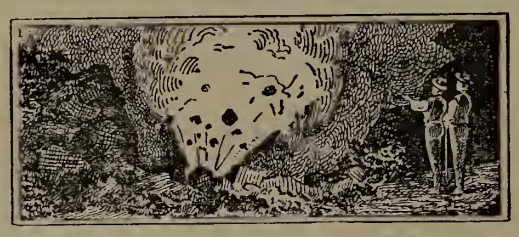

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Coal, 10 cts. per ton of 2,240 lbs.
Copper, 4 cts. on every 1 per cent. in a ton of 2,352 lbs.
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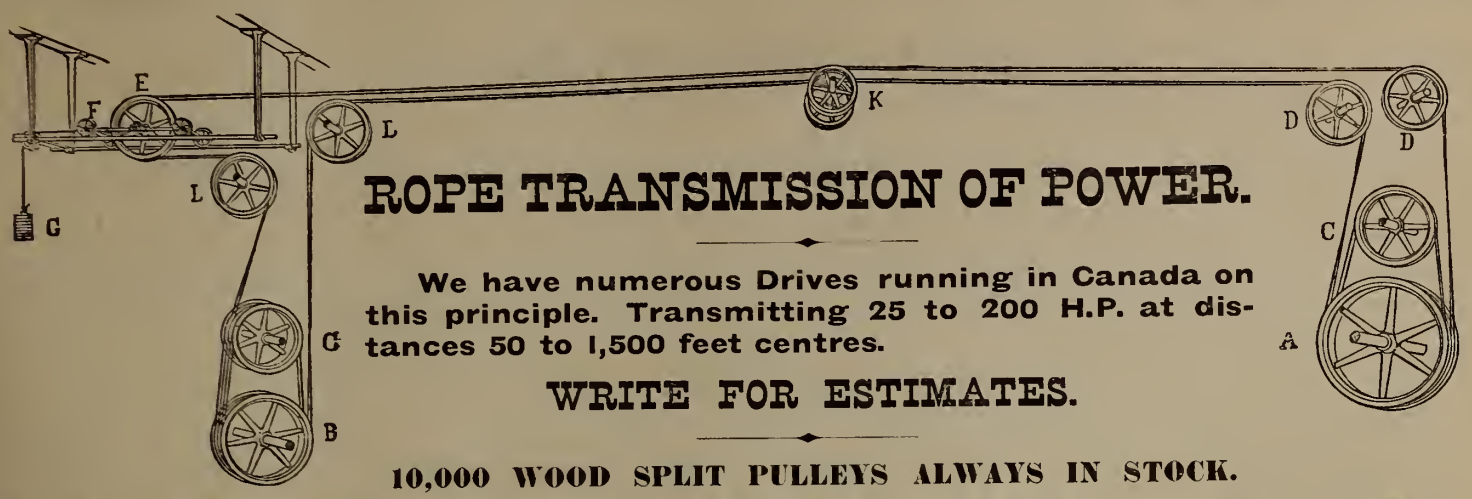

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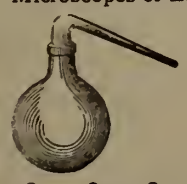

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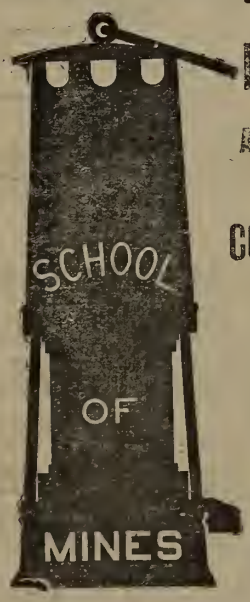

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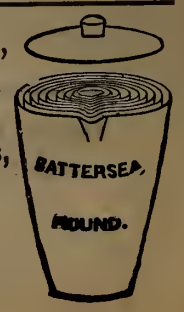

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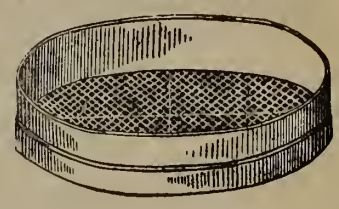

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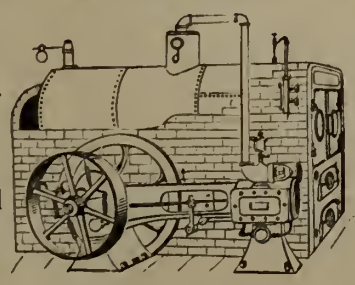

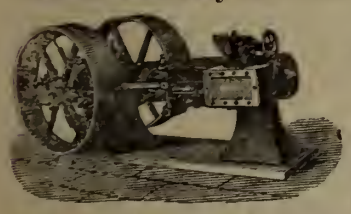

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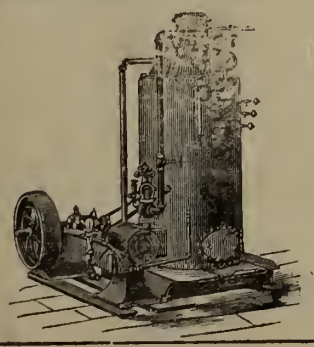

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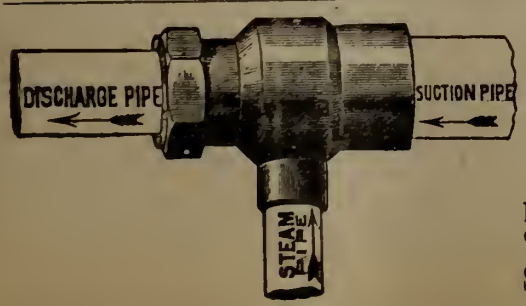

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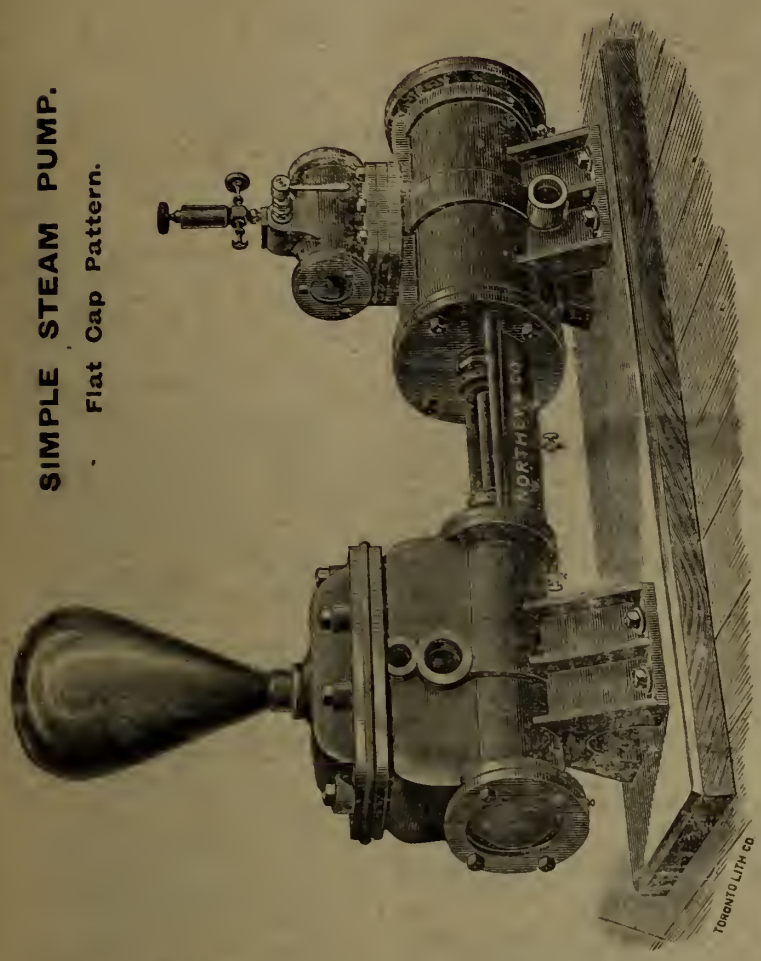

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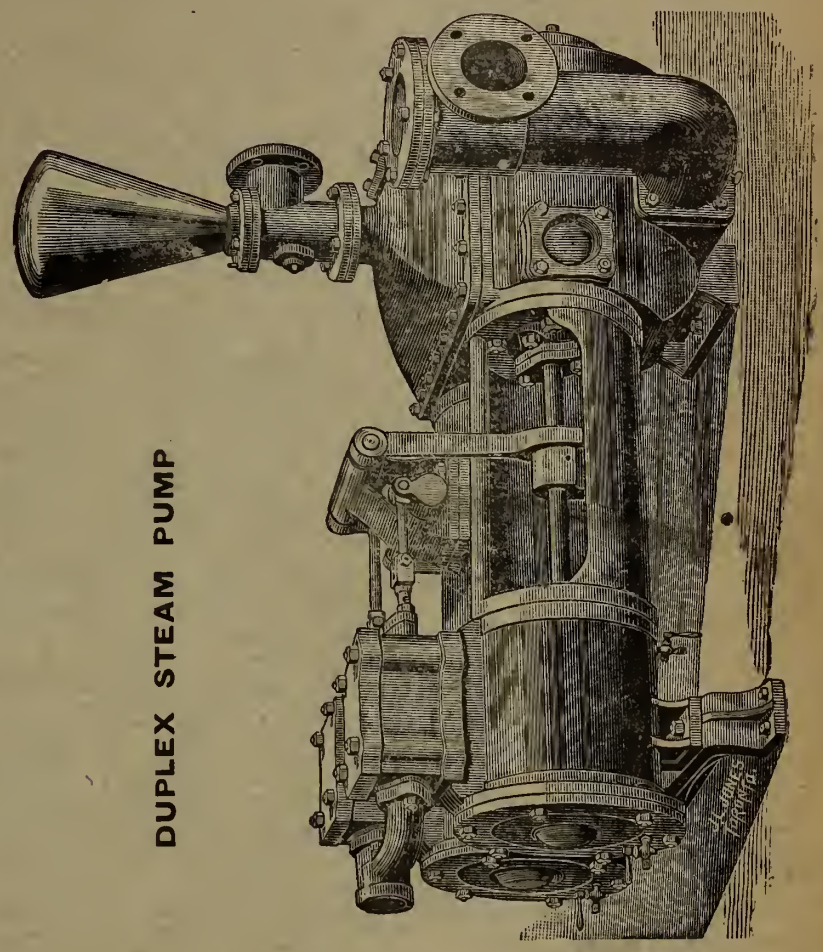

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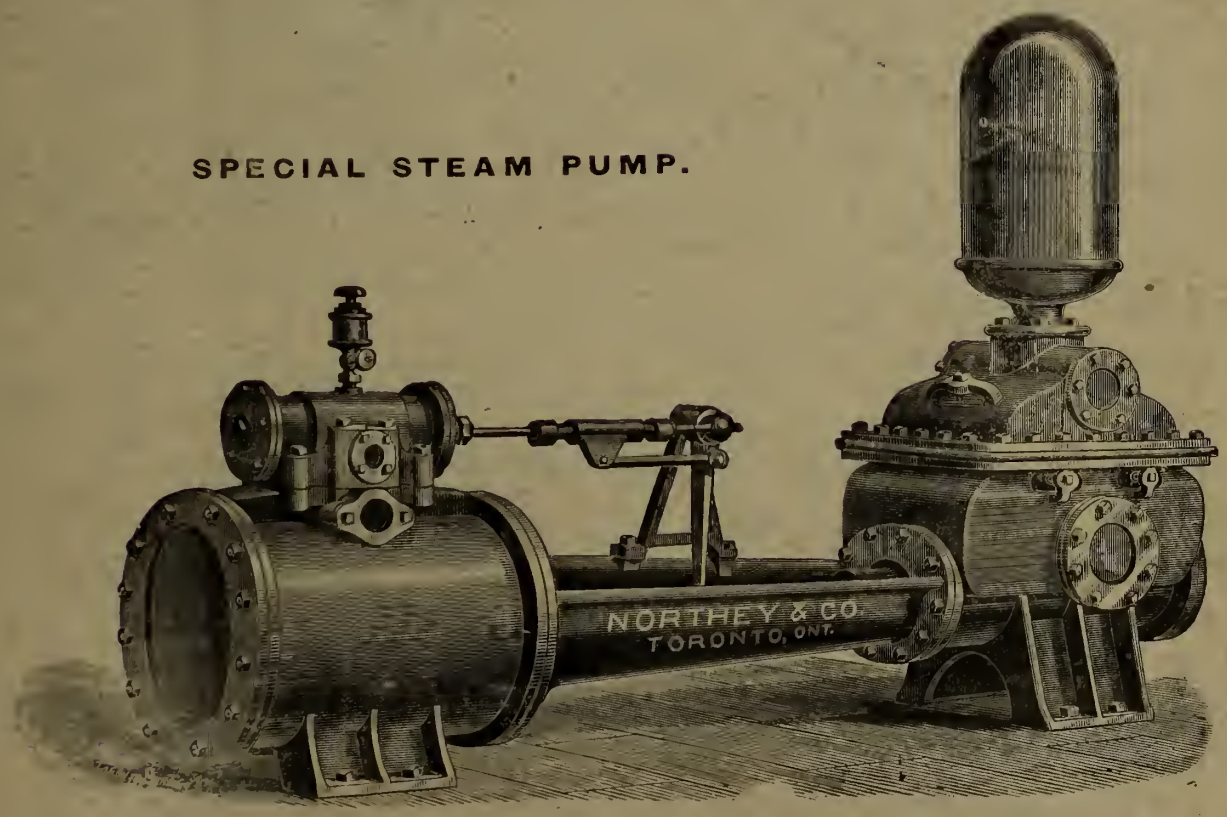

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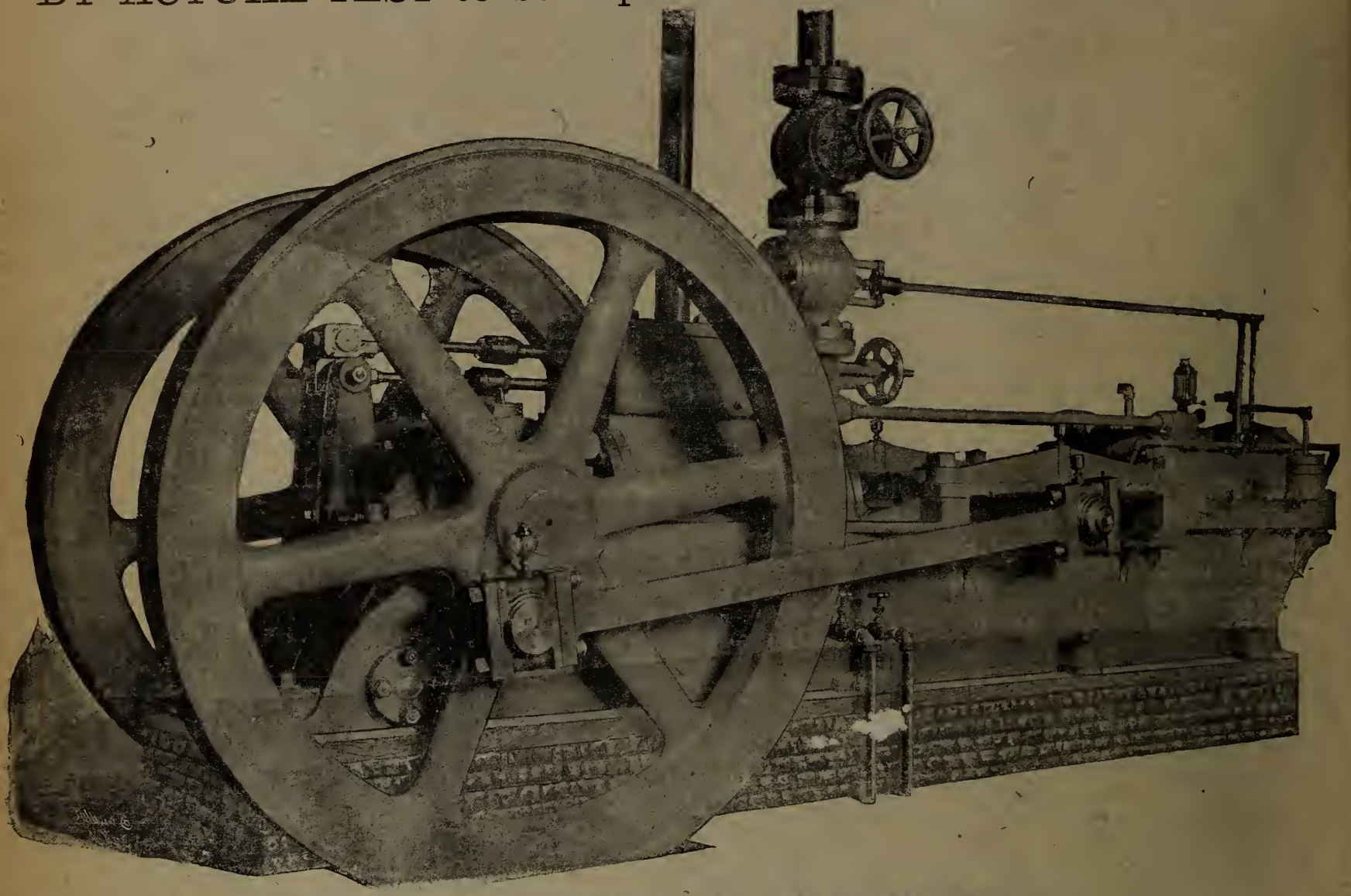

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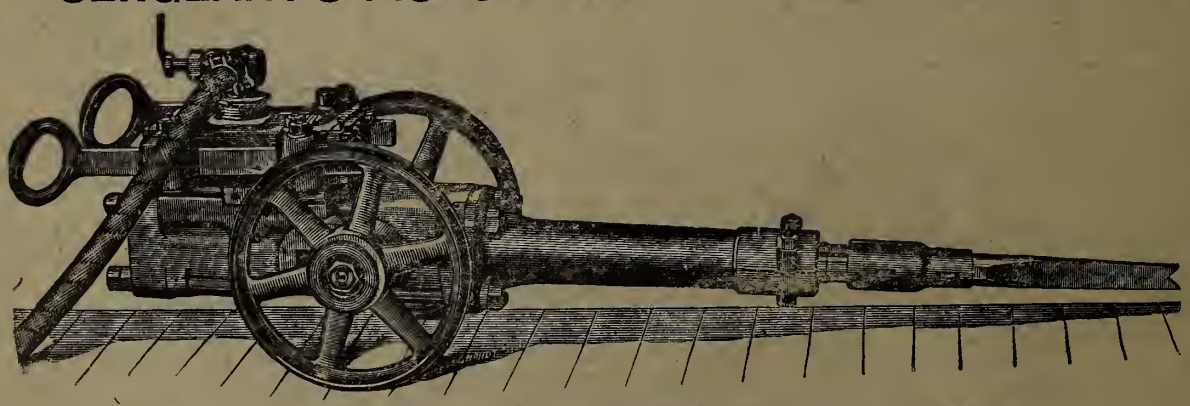

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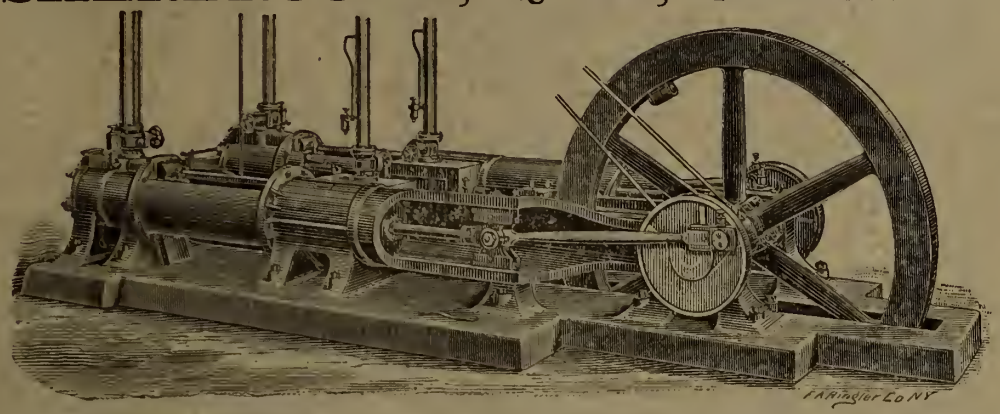

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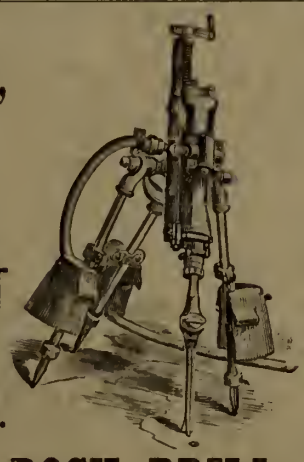

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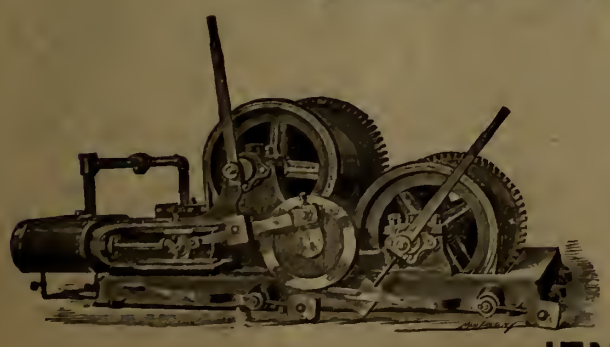

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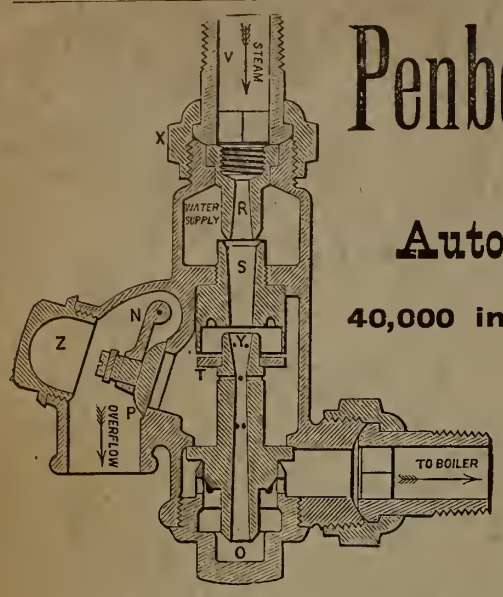

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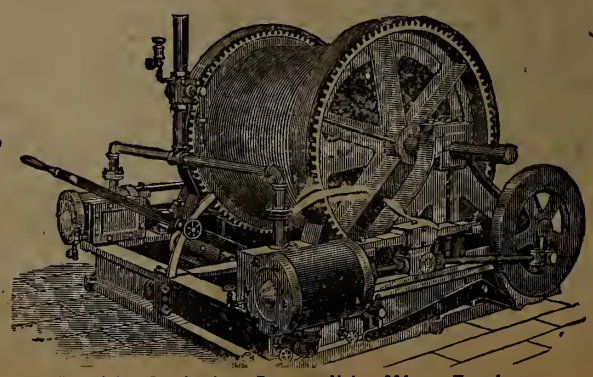

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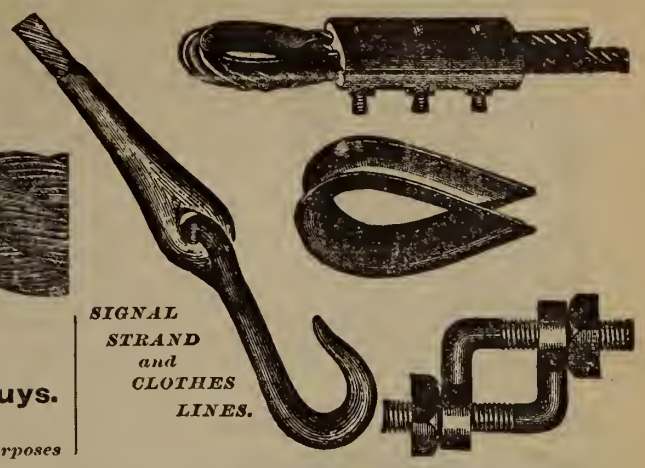

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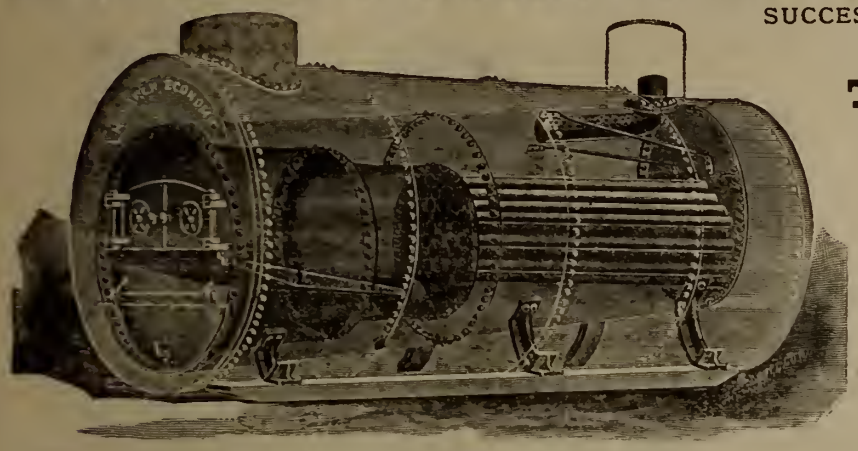

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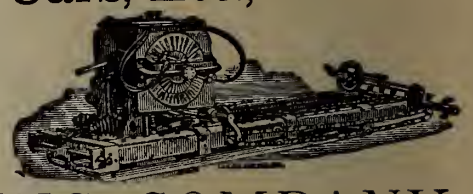

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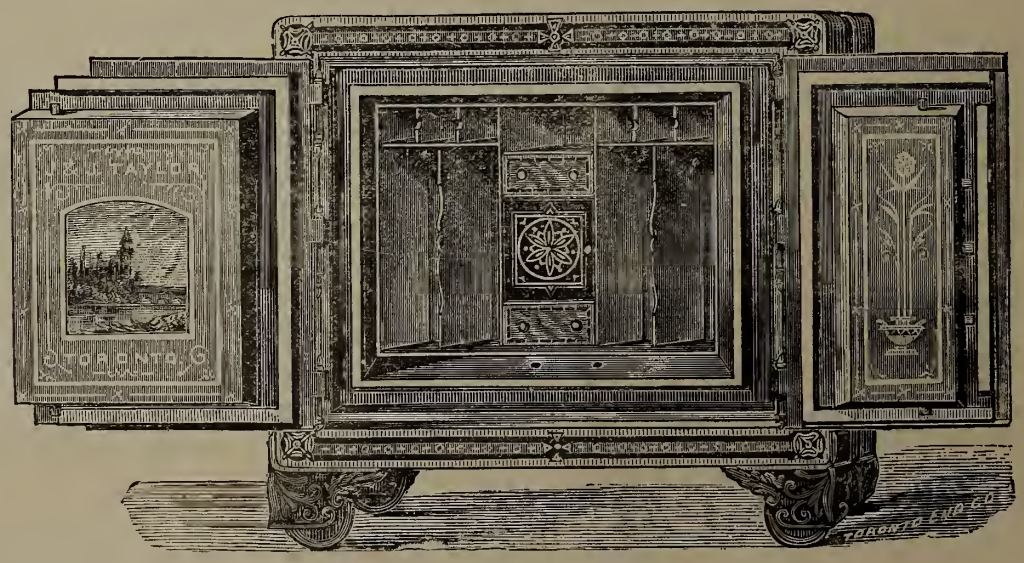

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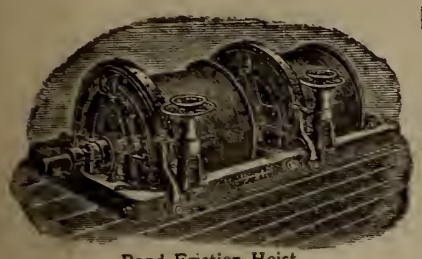

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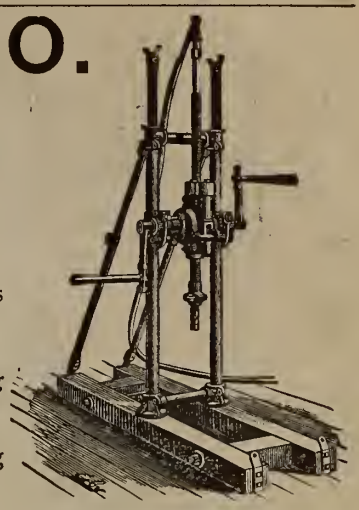

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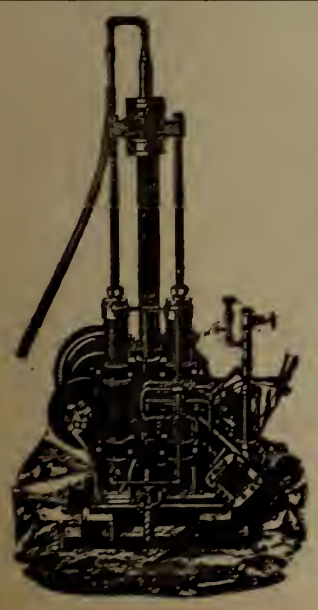

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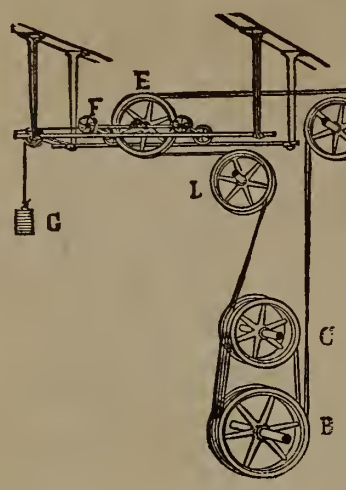

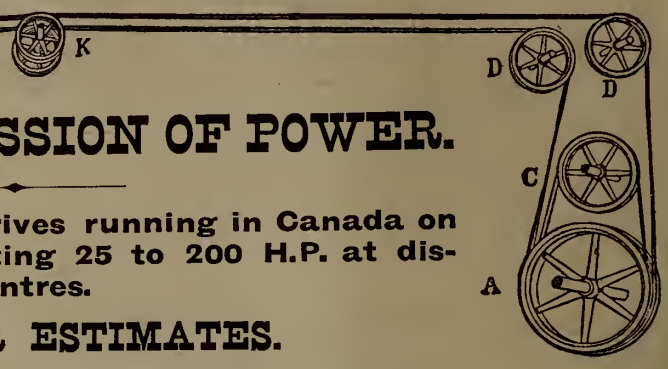

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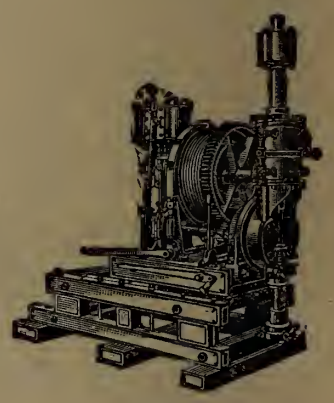

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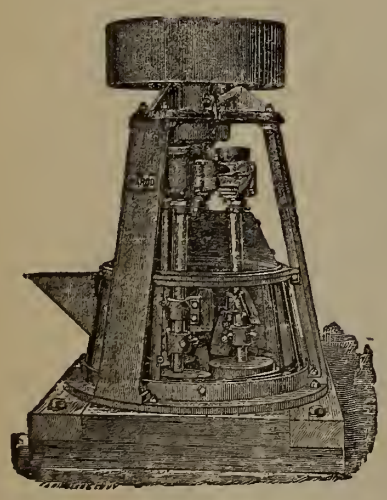

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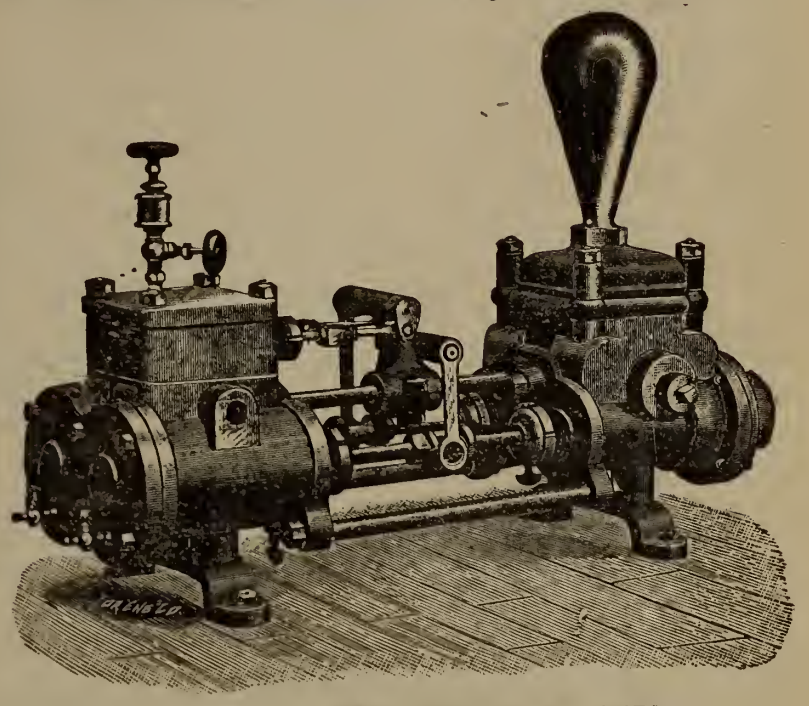

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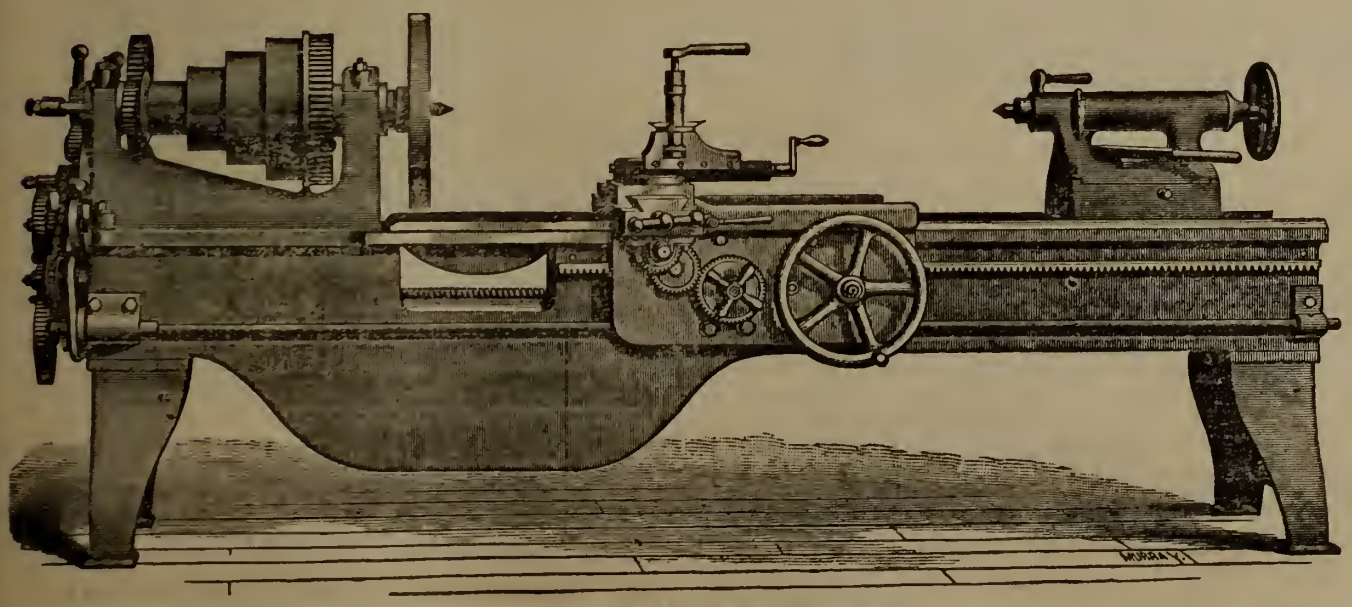

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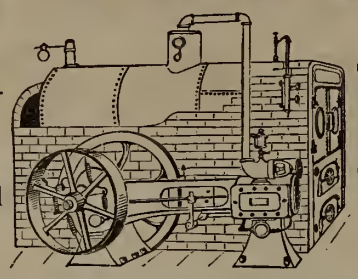

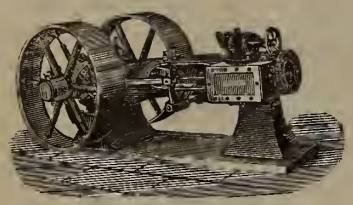

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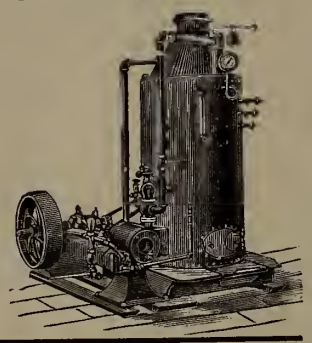

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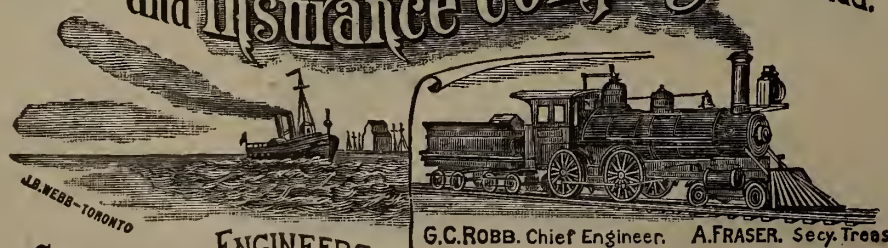

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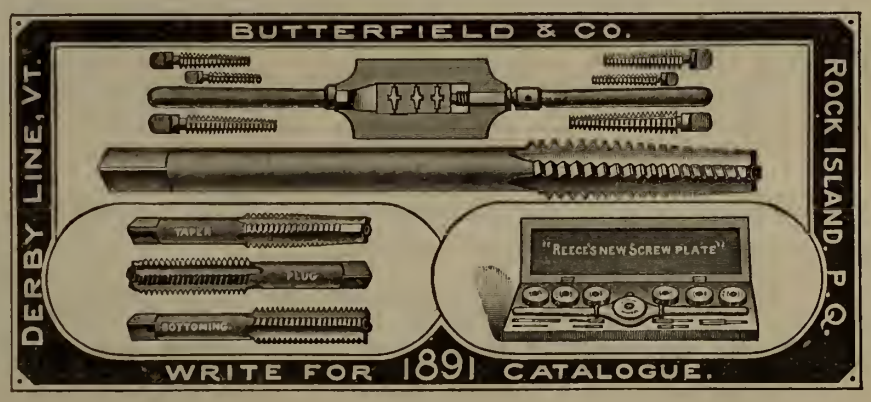

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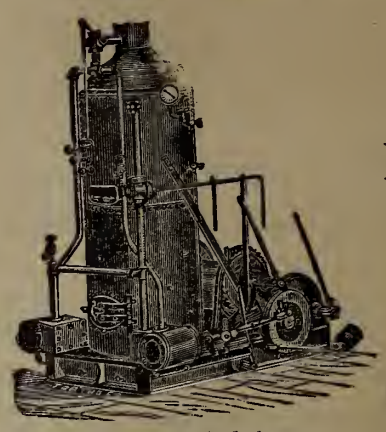

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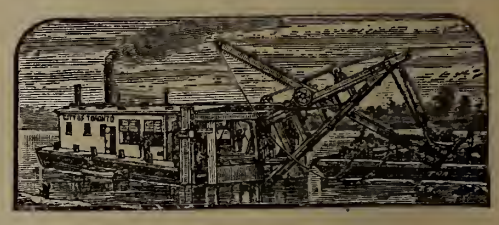

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Vol. XI. FEBRUARY, 1892. No. 2.

The Gay's River Conglomerates.

In another place our readers will find an interesting letter from Mr. R. R. McLeod, of Brookfield, N.S., in which he takes us to task for our reference to the conglomerate deposits of the Gay's River district, made in our last month's review of the gold mining industry of Nova Scotia. We gladly give space to Mr. McLeod's letter.

Since the discovery in 1862, and the first published notice by Professor Harte in 1864, of the mode of occurrence of the gold of this interesting district in the conglomerate of its consolidated alluvion or indurated sea beach or river bed, no inconsiderable amount of money has been spent in almost continuous mining and prospecting, as detailed in the yearly reports of the Department of Mines; yet "it has never occupied an important position as far as its yield of gold is concerned." Its yield has seldom been included in the reports of the inspectors of mines, notwithstanding the well known fact that gold in considerable quantity has been occasionally found in rich pockets in the position so well described by our correspondent. From the Inspectors' reports we learn that the conglomerate itself carries little or no gold, the portion next the slate being alone auriferous; that little of the conglomerate is consequently "pay dirt," and that the upper part of the slate which underlies the conglomerate—into the cracks of which, now filled with clay, the gold finds its way—is often the most productive. A large quantity of material has to be handled for the moderate yield obtained.

For our opinion of the value of the alluvial deposits as compared with the mining of the quartz leads, we have only the experience of all the alluvial diggings of the province, quickly exhausted, low lying, too expensive to work by reason of the great tenacity of the clayey deposit, the absence of any considerable amount of superficial soil from a great portion of the surface of the gold-bearing rocks, and the insufficient concentration of the gold in the drift.

But as Mr. McLeod reminds us, doctors disagree. Mr. Michel, Dr. Hunt, Professor Hind, Dr. Selwyn and others, who have studied the subject, insist upon the importance of carefully searching in certain parts of Nova Scotia for rich alluvial deposits, asserting that "they have never yet been sought for with that degree of enterprise, intelligence and perseverance which the investigation demands;" and Professor Bailey, after a survey of some of the Western Counties deposits, has again lately called attention to the subject. A full discussion of this side of the question will be found in Professor Hind's report on the Sherbrooke gold district.

Phosphate and its Mining.

Perhaps there is no kind of mining at the present time, outside the precious metals and gems, attracting public attention more than that of phosphates.

Affecting as it does the actual food supply of the world, this mineral may be considered more useful than iron, richer than gold, and more precious than rubies. It is the food of plant life and restores to the earth the virtue which has gone out of it in the process of germination; and from the exhausted soil, impoverished through excessive fecundity, it induces fresh and renewed fertility, and causes the blessed corn and fruit to spring forth in perpetual bloom and abundance to feed and gladden all living things.

In most long settled and long cultivated countries the land has become worn out and weak through the perpetual drain on its fruitfulness. For many centuries the farmers have sown and reaped successive and exhausting crops to supply the necessities of an ever-increasing population without realizing that this process must inevitably ruin the soil, unless the fertilizing elements of its composition, slowly extracted with the plant's growth, were returned to it in the shape of manure. First it was thought that the land required rest, merely; hence the ancient custom of "fallow." Presently, however, it must have been observed that where the excrement of the cattle fell and rested, there the crops sprung up in greater luxuriance than in other places; and then, by rule of thumb, the custom would be established of spreading the collected and saved up excrementary matter to produce the same good effect over a larger area, without reasoning that these droppings were the undigested and bulky portion of the food taken by the cattle and contained to a large extent the elements of fertility which the economy of nature demanded to be returned to the soil in order that it might recoup itself for loss sustained in bearing fruit and insure perrennial rejuvenescence.

It has long been customary in Great Britain to insert a clause in farm leases to the effect that straw should not be sold or removed off the property, in order that what was not used for thatching and like purposes might find its way in the shape of "chop" or bedding to the manure heap and thus help to fertilize the ground from which it was raised.

The effect on soils, too, by their admixture with the surface of the rocks lying immediately beneath them, such as marl, chalk, etc., must have led to similar deductions with regard to the earliest use of mineral manures, and though spoken of generally as mineral, most of them, such as peat, marl, chalk, coprolite, osite, guano, etc., are of organic origin, but which are now separated from the organic because they have become more or less mineralized and form part of the composition of the earth's rocky crust.

Of late years the light of science has been thrown on the subject, and the geologist and chemist have come to the aid of the agriculturist who now finds that scientific knowledge is as helpful to him as it is to all other producers of the present day. Books have been written on the subject, research and experiment have been made and the results marked in the records of the agricultural societies of the world; and now the sons of the soil realize that it is not enough to be able "to plough and to sow, to reap and to mow, to be a farmer's boy," but that if they aspire to be high class farmers they must have some intimate acquaintance with geological and chemical science.

The result of all this is evident; the progress thus illustrated is the inevitable progression which accompanies the advance of civilization and education.

The increasing demand for a higher yield of food from the earth, as its population becomes denser, will stimulate the efforts of those who seek to supply the want. Land now lying exhausted and useless will again be brought into cultivation by means of artificial fertilizers.

Lands in the United States and Canada and other great food producing countries, which are now being so impoverished by successive crops of cereals without adequate replenishment, will necessitate before long the increased use of manufactured manures in which the use of mineral phosphate stands pre-eminent.

And this means the increase of the demand for phosphate and the prosperity of this great mining industry.

The rapidly increasing consumption of phosphates in the United States strongly corroborates this view.

The exhaustive report of the Anglo-Continental Guano Co.'s London agency, on "Phosphates in 1891," recently issued, estimates the consumption in the United States in that year to amount to 500,000 tons; the consumption of the whole world amounting to 1,625,000 tons.

Enormous as these figures appear at first sight, they are but infinitesimal atoms in comparison with the vast area of land under cultivation in the whole world.

The Dominion of Canada, although herself the fortunate possessor of the most valuable mineral phosphates in the world, does not appear to be a large consumer of this precious product herself.

Probably this may be traced to two main causes, firstly, the vast area of her agricultural land in the Canadian North West is too virgin and young to feel the effect of exhaustion yet, and secondly, the farmers who cultivate the lands of the lower provinces, which undoubtedly stand much in need of fertilizers, find it more expedient to desert an old and used up farm altogether for the rich unimpoverished lands of the North West rather than expend the little capital they

have in rejuvenating their old homesteads. It is much to be regretted, if this is true, that the advantages of scientific farming are not better understood and appreciated, because in spite of the apparent unkindness of the winters here, nature seems to compensate for this by the magnificent growing weather of her summers, when the moist, rainy spring is succeeded by the long warm summer with its heavy night dews, followed by a dry harvest time and Indian summer.

Yet the land of the lower provinces has been terribly neglected and impoverished, and the use of manure of any kind is most exceptional. One can hardly pass through long stretches of such land without thinking how smiling and beautiful it might become under improved cultivation.

The provinces of Ontario and Quebec, possessing as they do the richest phosphate mineral in the world, are probably among the smallest class of consumers of superphosphate.

But however this may be the fact still remains that the mountains of these provinces contain vast deposits of this mineral; and whether its value is appreciated now or later on the phosphate still remains a practically inexhaustible store for the world's future use.

It has been stated, by perhaps not entirely disinterested critics, that the phosphate mining of Canada has seen its best days and that it will be swamped by the alleged more easily worked mineral of Florida and South Carolina—conclusions which are, however, not proved by the evidence produced in confirmation of this opinion, even though they point to the low prices and general depression of the market as a corroboration.

The Florida discoveries are but of quite recent date, and until we are quite certain of the results of the mining and concentrating efforts now being applied and the cost of production, apart from the prospective estimates and inflated glamour of the "boom," it is quite unsafe to rely on the figures and facts of the exploiters who have phosphate lands to sell, and which perhaps need the admixture of the proverbial grain of salt with the usual caution in regard to speculator's figures.

The present low prices may not be due to large stocks or anticipated flooding of the market at all, but to the remote financial causes which occasionally sweep like a tidal wave over the commercial world without any apparent traceable cause.

It is comparatively easy to form an estimate of the superficial area of the Florida deposits owing to their uniform character of occurrence and comparative evenness of the ground. But it is equally easy to assume too much and overestimate the phosphate area, particularly on the part of those whose wish is father to the thought.

It has been stated on good authority that the mineral costs more to raise and prepare for sale than was so sanguinely counted on even by the most moderate operators.

The character of the ore is that of a mixed and dirty kind, always difficult to cencentrate into a large proportion of high grade.

The Canadian apatite, on the contrary, is usually of a very clean kind, and though the very similar specific gravities of the associated minerals requiring to be separated in the process of concentration presents a difficulty and necessitates the use of delicate plant, the experiments already made show that this is not an insuperable difficulty. The clear, bright and distinctive colour also make it comparatively easy to pick out the massive lumps of pure ore which do not need cobbing or breaking up, and the colour is readily distinguishable after wetting. The pure phosphate is also much more friable than most of the associated atoms, and will consequently crush much finer and pass through a much smaller mesh, which will reject the objectionable matter.

The Canadian phosphate, though older than the Floridian, is after all still an infant industry, and how little is the deposit understood and its mode of occurrence and origin accounted for?

These deposits were first discovered and worked by farmers of the locality, and the mining and separating skill brought to bear on the work has been such as might be expected from this class of men. It is only within recent years that practical mining skill has been applied, and that only in isolated instances, and this, following much the example of the earlier workers, has resulted in but very indifferent success.

The physical aspect of the occurrence of this mineral has also been to a considerable extent misrepresented, and the views concerning it are still extremely conflicting.

The belts or zones have been arbitrarily determined and marked down on copies of the Township maps at the sweet will of the local and self constituted experts, whose pecuniary interest in the sale of these properties was not likely to conduce to the scientific accuracy of the belts, which appear rather to have been located by the position of workings already opened at random than by geological indication of the mineral within the limits of these zones.

The discovery of the mineral outside and distinct from such limits, and the frequent disappointment of those who sought only within these magic circles, proves how misleading such evidence invariably is, and how worthless for any purpose whatever.

Most of the mines of any consequence have been opened on the track of other industries, such as the lumber trade, and consequently at the most accessible places by river or road. And it cannot be wide of the mark to assume that but for these arteries of transport the deposits of phosphate might have remained undiscovered for ages, and shows how desirable it is that the Government should take upon itself the responsibility of constructing roads and railways with a view to the development of the vast deposits of this mineral which undoubtedly exist in the enormous volume of phosphate bearing ground lying within the area of the Laurentian mountains.

No one can climb to the top of one of these lofty and commanding ridges and look around as far as the eye can reach without noting the same grand outlines of its escarpments, troughs and ridges, ever increasing in magnitude and boldness in proportion to their altitude, but retaining throughout the same remarkable geological characteristics, without feeling convinced that as the mineral has been discovered in the comparatively cleared region, so it will eventually be found in the yet unexplored and trackless areas of the same rocks of this immense Laurentian region, and not unlikely in larger and more promising deposits than ever yet discovered.

Judging from the very small proportion of phosphate ground opened out, we may assume that the deposits still unworked and unexplored are practically inexhaustible.

The demands of the phosphate market and competition will most probably result in a better system of working of the mines already opened out. A more scientific method of mining and dressing the ore will have to be adopted.

The exaggerated and unfaithful reports of interested speculators and experts must in future be ignored. The ridiculous estimates of ore which can be raised from untried or superficially prospected ground in the very beginning of a mine must be treated with the contempt they deserve, and which would be accorded at once to such irresponsible statements in any other business but mining.

Freeing ourselves from the primitive methods of mining and dressing, it now rests with the engineers to show us how to deal mechanically and cheaply with the large masses of rock to be removed in order to win the mineral cheaply, expeditiously and without waste. Machinery must be carefully designed to meet the requirements of almost perfect concentration, i.e., to produce the very highest grade the ore is capable of with the least possible sacrifice of any of the mineral. The magnificent water powers of the phosphate region must be compelled to the use of the miner in operating the mechanical methods which the exigences of the present day demand in order to insure cheap production of the mineral. The distances in no instance are prohibitive to the use of these gratuitous sources of power now-a-days, when the difficulties of transmission have been overcome by the skill of the electrician, or the compression of the atmosphere; the cost of the medium of transmission being often more than compensated for by the diminished cost of the motors used in such methods.

It may be taken for granted that the enlightened and scientific farming of the future will create an ever increasing demand for phosphate. The exhaustion of what was considered inexhaustible supplies of guano in the past with the comparatively small consumption of those days, can by a very simple process of inductive reasoning be made to show that the much larger deposits of phosphates of Florida, South Carolina and Canada, will most likely prove inadequate to meet the eventual demand which is sure to be made on these resources. And it is equally certain that as the quality of Canadian phosphate stands first in the list there will always be a demand in her favour for all she can produce.

J. B. Smith.

Imports of Mining Machinery.

From the trade and navigation returns, just issued, we reproduce the figures there given of the imports of mining machinery into Canada during the fiscal year ended 30th June, 1891. As our readers are aware, the Dominion Government in 1890 admitted free of duty all machinery for mining purposes not manufactured in the country. The returns show a very satisfactory increase which should be more than maintained during the period ended 30th June, 1892. The figures are :—

To Ontario.. ....$26,134		From Great Britain.$12,194	
" Quebec.... .. 25,378		" United States. 66,238	
" Nova Scotia.. 14,578			
" N. Brunswick.. 2,583			
" Manitoba..... 4,895			
" B. Columbia... 4,864			
	$78,432		$78,432

In the previous fiscal year, 1889-90, the imports of mining machinery to the several provinces from Great Britain and United States were as follows :—

To Quebec.. ....$ 6,182		From Great Britain.$ 6,182	
" Ontario..... 473		" United States. 3,768	
" Quebec..... 2,555			
" B. Columbia... 740			
	$ 9,950		$ 9,950
To Ontario... ... 11,798		From United States under Order in Council..... 11,798	
	$21,748		$21,748

Canadian Exports of Minerals.

The following are the mineral exports of Canada as per Trade and Navigation Returns for the year ended 30th June, 1891.

	Quantity.	Value.
Asbestos first class, (tons).....	5,180	$ 413,231
" second class "	1,449	83,639
" third class, "	393	17,039
Barytes, ground and unground.....(cwt.).....	170	1,190
Coal.....(tons).....	833,684	2,916,465
Copper ore.....("	3,074	269,169
Copper matte or regulus of, and black or coarse copper and copper cement, fine copper contained therein.....(lbs.).....	1,719,990	64,719
Fine copper.....("	3,116,508	171,308
Gold-bearing quartz dust, nuggets, etc.....($).....		554,126
Gypsum or plaster and crude.....(tons).....	172,496	184,977
Mica, crude and cut, (lbs.).....	163,904	19,666
" ground.....($)		2,646
Nickel, fine, contained in ore, matte and speiss.....(lbs.).....	5,352,043	240,499
Oil, mineral, crude, (galls.).....	434,699	18,436
Oil, mineral, refined, "	1,817	290
Ore, iron.....(tons)	14,648	32,582
" manganese.....("	880	16,218
" silver.....("	309	238,367
Phosphates... .....("	24,257	422,200
Plumbago..... .(cwt.).....		163
Salt.....(bush.).....	5,706	1,429
Sand and gravel.....(tons).....	324,120	63,326
Stone, ornamental, granite, marble, &c. unwrought.....("	1,189	9,307
Stone, building, free-stone, limestone, etc., unwrought.....("	15,048	38,504
Other articles.....($).....		4,647
Total produce of the mine..... .....$		5,784,143

Port Arthur has decided to have a mining school, and the city and surrounding municipalities are being approached to furnish the wherewithal to equip and keep it going. Is this not a little premature?

EN PASSANT.

The recent issue by the Geological Survey of the new sheet map of Nova Scotia, on the reduced and perfectly useless scale of four miles to the inch, instead of one mile as universally demanded, has, as was predicted, provoked a storm of indignant protest from the miners of that Province. Mr. Hardman's letter, published elsewhere, clearly indicates the situation. We are glad to learn that the matter will be brought before Parliament during the coming session.

A Pennsylvania Commission has been appointed to enquire into the utilization of anthracite coal dust, which accumulates in such enormous quantities around the mines. Numerous schemes for its use have been suggested and a large number of contrivances patented with a view to using this waste product. In round figures, there has been mined in Pennsylvania 700,000,000 tons of coal and of this it is estimated that about 10 per cent. or 70,000,000 tons is in the form of dust or waste.

General I. J. Wistar, President of the Philadelphia Academy of Natural Sciences, makes bold to say that the coal supply of this North American continent of ours will only last 112 years. He states that "after enjoying considerable opportunity of personal observation of the great coal fields of the United States, Nova Scotia and British Columbia," he does "not believe that the entire carboniferous exposures in North America contain 250,000 square miles of actual coal beds, including all qualities and thicknesses." He believes that an average thickness of considerably less than 6 feet will have to be assigned to the workable seams of the country, but assuming 6 feet to be an admissible working estimate, and assuming the received quantity of 800 tons (about 42 per cent.) as that which is on the average mineable per level acre per foot of thickness, we should then, by a simple arithmetical process, get the following, viz: 219,080 square miles equals 140,211,200 acres, multiplied by 6 feet (of thickness) and by 800, the available tonnage per foot of thickness from each acre, which would give the available tonnage as 673,013,000,000 tons. It was learned from the census that the production, and therefore the consumption, during 1889 was 126,097,779 tons, and also that the increase of consumption has been at the rate of 97·57, or nearly 100 per cent. per decade. "This rate of known actual increase," explains General Wistar, "applied to the present annual consumption for thirty years, then reduced to 50 per cent. per decade for the next forty years, and further reduced to 33⅓ per cent. per decade for another forty-two years, would indicate the entire consumption of every accessible ton at the end of 112 years from the year reported on, or say A.D. 2,001." It is probable, of course, that the rate of annual increase of consumption would, during the first half of the period, show a more rapid acceleration, owing to increase of population, exportation and the new applications of steam power. "During the last half of the period it would decline, in consequence of exhaustion of coal fields, growing scarcity and higher prices. But with any reasonable rate of increase the general result will be about the same—viz: practical exhaustion in little more than three generations." The General does not appear to include in his calculations the great coal areas of our North-West Territories.

In a recent article in the *Colliery Guardian* a Canadian correspondent furnishes some interesting information respecting the coal measures of Cape Breton. Commenting upon the Upper Province markets for Cape Breton coals, the writer says: "During the present year this coal market has reached its greatest proportions, the increase being really remarkable. Cape Breton finds the largest purchasers, no less than 410,000 tons having been required to carry out current contracts, during the past season. In addition 108,000 tons were distributed between Quebec, Sorel and Three Rivers, which swells the St. Lawrence trade of the island to 518,000 tons, an increase of 50,000 tons over last year's consignments. Competing with Cape Breton, Nova Scotia proper shipped 194,000 tons of coal to the St. Lawrence district, a decrease of 8,000 tons over last year. It is evident then, that Cape Breton is driving Nova Scotian coal out of the market; British coal is sharing the same fate. The imports last year were 40,000 tons; during this season only 25,000 tons, a decrease in favour of Cape Breton coal of 15,000 tons, or nearly 40 per cent. British competition is, however, so insignificant that another season or two will probably wipe it entirely out. Cape Breton coal has been largely used on Canadian railways, and comparing favourably with the best imported coal, has in many cases earned a preference. Newfoundland sealing steamers prefer it to all other, owing to the rapidity with which it raises steam, and the port of Sydney has earned a just notoriety as a bunkering depot. Among markets prospective, that of the New England States and Upper or Western Canada are the most valuable. The New England States consume 5,000,000 tons of coal annually, every pound of which is bituminous, and a political agitation is now manifest, which may result in a repeal or modification of the coal duties, thereby broadening the market for the Canadian mineral."

The largest driving belt in the world has just, says London *Iron*, been turned out at the works of Mons. Domanage-Scellos, Boulevard Voltaire, Paris. It has been made to the order of an Amiens manufacturer, and is intended to transmit 1,000 horse power. It is on the homogeneous system, that is to say, it is composed of a large number of leather bands interlaced with each other, and secured by strong cords. It is 120 feet long, seven feet wide, and nearly an inch thick, the weight being a ton and a half; and it is to put a fly wheel 22½ feet in diameter in communication with a pulley over eight feet in diameter. Its speed under ordinary conditions will be 67 feet per second. The steam engine intended to run with this gigantic belt is being built by Mons. Dujardin, of Lille.

Although quite beyond the province of this paper to indulge in matters political, the REVIEW may, we hope, be fairly excused if for once it breaks the rule, to endorse the candidature of Mr. James King, one of the vice-presidents of the General Mining Association, who is running for Megantic County, and Mr. W. J. Poupore, the late and prospective member for Pontiac County, also a member of the Association. Both gentlemen are prominently identified with the mining industry of the Province, and may be relied upon to look closely after its best interests in the Local Legislature if elected. The mining community has not forgotten Mr. Poupore's determined stand, and his magnificent fight almost single-handed against Mercier's iniquitous Mining Bill last session. We hope to record in our next issue that both gentlemen have been returned by sweeping majorities.

The report of the first annual meeting of the General Phosphate Corporation will be read with no inconsiderable interest and curiosity by many of our readers. The position of the company is not encouraging, and more than confirms our prognostications when it was incorporated eighteen months ago; this is all the more to be regretted as its ultimate failure must be fraught with serious results to the development of the Canadian phosphate industry. The balance sheet submitted to the shareholders is a wonderful document, and deserves to be fyled for reference by those advocates of the introduction of English capital to this country, irrespective as to how it is promoted and managed. Our readers will doubtless draw their own conclusions from the following expenditures excerpted from the accounts:—

Purchase of Property, including:

	£	s.	d.
Expert's and surveyor's fees, interest, charges, etc	98,863	11	1
North Star property deposit	7,798	10	6

London Expenditure, including:

	£	s.	d.
Legal expenses	721	16	11
Travelling expenses	695	16	8
Charges re-issue of debentures	15,526	14	7
Directors' fees	3,714	15	10
Interest on debentures	1,988	11	2
Amounting in all to	23,686	17	7

Mine Expenditure including:

	£	s.	d.
Labor	4,036	7	11
Supplies	2,032	9	9
Provisions	1,550	1	2
Mine development	1,190	5	9
Buildings	1,542	12	4
Plant	3,892	16	0
Salaries	1,126	2	8
Office furniture	99	16	0
Etc., etc., or	18,507	10	6

A Manchester firm, Messrs. Sutcliffe & Co., are the inventors of a novel prospecting instrument of interest to those interested in metalliferous mining. It is intended specially for ascertaining the presence of gold and other metals beneath the surface of the earth, and it is said to be more particularly adapted for prospecting for alluvial deposits. The instrument consists generally of a steel tube carrying an inner rod which communicates by means of a wire with a small battery, easily carried on the person of the prospector. On reaching the locality in which it is desired to operate, the boring instrument is thrust into deposits, beds of rivers, or other situations, and so long as it does not meet with metallic obstruction, such as a gold nugget, or a deposit of gold dust, auriferous ore, or other metal deposits, no electrical communication takes place between the instrument and the battery; the bell therefore remains silent. But should the point of the rod strike against, or enter a metallic obstruction, the electrical alarm is sounded. The instrument is, the makers state, of such accurate construction, that should a piece of metal of less size than a pin's head come in contact, its presence is instantaneously indicated. The core of the instrument is moveable, and when it is wished to take out a sample of the soil into which the instrument has penetrated—as for example when the bell rings, or other indication is given of the presence of metal—the bayonet joint in the head is operated, bringing a "snug" button from the lower slot to the upper, thus causing the core to slide within the outer steel sheath, the latter being then in advance of the prospecting point. This portion of the hollow sheath is pushed, without altering the position of the instrument, into the soil, and withdrawn bringing with it the sample. The sample is pushed out by returning the parts to their normal position, and the soil can then be examined, analysed, or washed in a pan. The instrument is made in lengths within useful practicable limits, but the sizes from 5 to 6 feet long are most recommended by the makers. The steel tube and rod are enclosed in a scabbard made from bamboo, both light and strong, which may, however, be used as a protractor to lengthen the instrument in cases where it is to be used for prospecting in beds of rivers, or other places difficult of access. The whole apparatus is, the makers state, comparatively light, and can be carried by a man for a considerable distance and length of time in the manner of a walking staff, without adding to the discomfort of the person prospecting. It is claimed to entirely dispense with the cumbersome impedimenta which of necessity accompanies the prospector of the present day, a claim which, if realised in practice, he will appreciate. The instrument should form a useful part of the outfit of persons proceeding to a new, or unprospected country.

An English firm of engineers has patented an appliance which, while preventing the light from shining directly upon the eyes of the miner, focuses the rays upon the exact spot required. The invention consists of a shield of enamel which covers about three-eights of the surface of the tough glass cylinder that protects the flame. The enamel softens the rays of light, and, at the same time, acts as a reflector. The cylinder, treated in this way, adds an element of safety and comfort to the work of the miner to which he has been so long accustomed. The glasses may be either cylindrical, conical or any other shape, and the cheapness with which they can be supplied makes their universal use to be only a matter of time. The glasses have been subjected to a thorough test at the hands of practical miners in the Thorncliffe and other English collieries, and their verdict is very favourable.

The *Canadian Manufacturer* for some time past has advocated that the Dominion Government should take prompt and effective action to secure for Canada the benefit of our nickel wealth, by the imposition of an export duty upon the nickel contained in ore and matte taken out of the country. On this point, as applied to the principle of protection to Canadian industry, the *Manufacturer's* ideas are somewhat mixed. Should an export duty be placed upon our ore and matte, the result would be that none from Canada would be purchased, and no exports would be made to the United States or Europe. The action would have the effect of raising the price of a Canadian product of as yet fluctuating value and of comparatively small sphere of application for industrial purposes, and of which we have a supply in excess of our own very small demands. Export trade is the only means of keeping alive this young industry, and to impose an export duty would be simply suicidal to the industry now started. As Canada has vast supplies of nickel ores, there is no fear of a shortage of that product for Canadian needs, even if the exports were largely increased, and on that account there is no necessity for curtailing this young industry. The United States or other countries are by no means dependent on Canadian supplies, hence the export duty is uncalled for and would only have the effect of crushing this young industry and promoting the mining of nickel ores in other quarters. In other words, we recommend the *Manufacturer* to "shut up."

All the devices in the steel works of Carnegie, Phipps & Co., constructed for the use of natural gas, are to give place to appliances for coal. The work is to cost $50,000. Among the improvements is a battery of 2,000 horse-power boilers, equipped with the Roney automatic stoker and automatic coal-handling apparatus. The boilers will be in a new and separate house surrounded by a smoke stack 8½ feet inside diameter and 200 feet high. The foundation for this stack will go down 40 feet. The coal which is to feed the smelting furnaces will be dumped from the cars into automatic conveyors which will carry it along overhead and dump it through chutes directly into the hoppers on the stokers. The ashes from the furnaces will fall through into chutes, which will deliver it at once into cars, thus doing away with the manual handling of either the fuel or the refuse. The smoke consumers and boilers are absolutely non-explosive, and so constructed as to save the company at least $10,000 a year in fuel. The new process of feeding and cleaning the furnaces will enable the company to dispense with the services of 15 men.

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. 16.

The Late T. Sterry Hunt, M.A., LL.D., etc., the First Chemist and Mineralogist of the Geological Survey of Canada.

Dr. Sterry Hunt, the well-known mineralogist, died at New York, on Friday, 12th inst.

Thomas Sterry Hunt was born in Norwich, Conn., on September 5, 1826, of an old New England family. His ancestor, William Hunt, was one of the founders of Concord, Mass., in 1635. His maternal grandfather, Consider Sterry, of Norwich, was a civil engineer and mathematician and was the author of text books of arithmetic and algebra, published 100 years since, in connection with his brother, Rev. John Sterry, a well-known Baptist divine. Mr. Hunt was destined for the profession of medicine, but after preliminary studies, his love for chemistry and mineralogy led him, early in 1845, to become a special student, and afterward assistant to Prof. Benjamin Silliman, sen., in Yale College. Two years later he was appointed chemist and mineralogist to the Geological Survey of Canada, (just then organized under Mr., afterward Sir W. E., Logan), a position which he held for more than twenty-five years, till his resignation in 1872. His work in that capacity is well known; to him was due the investigation of the petroleum, the salt, the phosphates, the iron and copper ores of Canada; while the literary work of preparing the reports of the Geological Survey was also mainly his. He it was who made the first studies of the lithology and mineralogy of the crystalline rocks of the Ottawa and the upper lakes. For many years he was obliged by circumstances to devote much of his time to field work in geology, and to the administrative duties of the Survey.

To Dr. Hunt we owe the first systematic attempt ever made to sub-divide and classify geologically the stratiform crystalline rocks; a work to which he brought not only his studies throughout Canada and the United States, but also the result of enquiries conducted during repeated visits to the British Islands and to continental Europe. To him we are indebted for the distinctions and the designations of Laurentian, Norian, Huronian, Montalban, Tacomian and Keweenian, all of which have long since passed into the terminology of science and the literature of geology. In connection with these studies he undertook the discussion of the great questions of the origin and succession of these rocks. Reviewing and controverting various hypotheses, including the igneous or plutonic, the metamorphic and the metasomatic, all of which he rejected as irreconcilable with observed facts and as violating chemical theory, Dr. Hunt vindicated what he deemed the essential soundness of the still imperfect Wernerian aqueous view, and advanced what he has named the crenitic hypothesis. According to this theory, which is fully explained in his "Mineral Physiology and Physiography," the source of the various groups of crystalline rocks above named was the superficial portion of a globe, once in a state of igneous fusion, but previously solidified from the centre. This portion, rendered porous by cooling, was permeated by circulating waters, which dissolved and brought to the surface during successive ages, after the manner of modern mineral springs, the elements of the various systems of crystalline rocks. These rocks thus mark progressive and necessary changes in the mineralogical evolution of the earth during the pre-Cambrian or Archæn ages. As the author disclosed in 1885, the new hypothesis was "the result of nearly thirty years of studies, having for their object to reconstruct the theory of the earth on the basis of a solid nucleus, to reconcile the existence of a solid interior with the flexibility of the crust, to find an adequate explanation of the universally contorted attitude of the older crystalline strata, and at the same time to discover the laws which have governed the formation and the changing chemical composition of the stratiform crystalline rocks through successive geologic ages."

Dr. Hunt's contributions to general chemistry are numerous and important, aiming at nothing less than a complete system of chemical theory, the outcome of which, after nearly forty years of thought, and the successive publication of many papers from 1848, was the production in 1887 of a volume entitled "A New Basis for Chemistry," which appeared in a second and augumented edition in 1888. This was translated into French by Professor Spring, of Liege, and published in Paris in 1889, as "Un Nouveau Système Chimique." The practical application of these new views to the science of mineralogy has been partially set forth by Dr. Hunt, in numerous papers, and is unfolded at greater length in his "Systematic Mineralogy," published last year.

Dr. Hunt has done much work as a teacher and a lecturer. One of the organizers of Laval University at Quebec, he was professor of chemistry in that institution from 1856 to 1862, during which time he delivered annual courses of lectures in French. He continued to be honorary professor until his death. He was also for several years lecturer in McGill University, Montreal, and was professor of geology at the Massachusetts Institute of Technology, 1872-1878. Among his academic titles were those of M.A., Harvard; Sc.D., Laval; LL.D., McGill; and finally LL.D., Cambridge, England. A Fellow of the Royal Society of London since 1859, he was a member of a large number of other societies, both Canadian and foreign. A member of the National Academy of Science since 1873, he had been president of the American Association for the Advancement of Science, and of the American Institute of Mining Engineers, and twice president of the American Chemical society. He was one of the founders, and the first president by election, of the Royal Society of Canada. One of the organizers of the International Geological Congress, he was its first secretary, and was a vice-president at the Congresses of Paris, 1878, Boulogne, 1881, and London, 1888. In connection with the great industrial exhibitions Dr. Hunt represented Canada as a member of the International juries at Paris in 1855 and 1867 and at the Philadelphia Centennial exhibition in 1876. He was an officer of the French order of the Legion of Honor and of the Italian order of St. Maurice and St. Lazarus.

In 1878 Dr. Hunt retired from public professional life, though much consulted on points of mineralogy, metallurgy and mining law. Within the past three years his health was

impaired, and at times he was very ill. Last fall he was able to resume his accustomed literary duties in New York, but the hopes of perfect recovery and prolonged usefulness thus inspired were unhappily doomed to disappointment.

Besides his various official reports, the list of Dr. Hunt's published papers, beginning in 1846, is over two hundred. An important volume of his, on "Azoic Rocks," was published as Report E by the Second Geological Survey of Pennsylvania in 1878. He has also published a volume entitled "Chemical and Geological Essays," of which a fourth edition appears in 1891. Of his "Mineral Physiology and Physiography," a second edition was published in 1890, and also a third edition of the "New Basis for Chemistry." These new editions, as we had occasion to mention some time ago, have been brought out by the Scientific Publishing Company, of New York, which has also published his latest work, entitled "Systematic Mineralogy," referred to in our last issue. Dr. de Kroustchoff, the eminent chemist and mineralogist of St. Petersburg, is said to have in hand a translation into Russian of a selection from the works of Dr. Hunt. Some of his earlier essays have long since appeared in the French language. Dr. Hunt was personally known to most of the illustrious scientists of the day, and by them his work was highly esteemed. His death at a comparatively early age is a loss to science which is sure to be felt. Dr. Hunt married in 1878 the eldest daughter of the late Mr. Justice Gale, who survives him.

It is our melancholy duty to record this month the death of Capt. Thomas Sheridan, manager of the Bell's Asbestos Company, which occurred at Thetford on Friday morning, 12th inst. He died of congestion of the lungs and brain fever. Captain Tom was widely known and universally esteemed by the mining fraternity in Eastern Quebec, more particularly of course in the districts of Black Lake and Thetford, where he was best known. Of him our correspondent writes: "I have had the pleasure of his acquaintance for several years, and to know him was indeed to love him; quiet and unostentatious in manner, his company was ever genial and hospitable; he was one of nature's truest noblemen and will be greatly missed in this district." Captain Sheridan took a lively interest in all matters pertaining to the welfare of the industry in his neighbourhood, and at his death was an esteemed councillor of the Asbestos Club. The funeral took place on the Sunday following his demise. The Asbestos Club contributed floral designs, and many of its members accompanied the remains to their last resting place at Lennoxville. The Bell's Company has lost an efficient and faithful officer, and the mining industry in Quebec one of its best friends.

The anthracite producers of the United States purpose, it is said, constructing a building at the World's Fair entirely of coal. It will contain 50,000 tons of anthracite. This will be a unique feature if carried out.

Our exchanges give particulars of a remarkable disappearance, in transit, of a casting weighing eight tons. The proprietors of the Edgar Thomson Steel Works, some weeks ago, ordered from a Pennsylvania firm a number of steel castings, in which was included a 17,500 lb. plunger to be used in connection with an hydraulic crane. The railway trucks with the castings on reached Braddock on December 15, and the men started at once to put the castings together. All went well until the time came to attach the plunger to the cylinder, when it was found that the plunger was missing. The Company was notified, and it replied that the casting had been forwarded. This puzzled the Braddock people, and greatly annoyed them. The Pennsylvania Railroad Company was accordingly informed of the loss of the casting, and urged to hunt it up as quickly as possible. The railway company was as confounded at the news of the loss of the casting as the Edgar Thomson people. Never in the history of the road, it was said, had a similar miscarriage occurred. The only supposition that could be advanced was that on one of the steep mountain grades and curves between Philadelphia and Pittsburg the big piece of steel had slipped off the car and rolled down into some neighbouring stream. The section-men, however, could not discover the slightest sign of the casting, and not a trace could be found of any damage caused to the roadbed or to any embankment which the sliding of so ponderous a mass assuredly would cause. On December 29, however, the casting was found in the Susquehanna River at Columbia, and delivered to its rightful owners.

"Didn't know it was loaded!" That's what the man with the gun invariably says after accidentally shooting some one. It has often been remarked that he rarely shoots himself by accident. It's quite the same with boilers. A man buys a secondhand boiler full of corrosion and saves money by the purchase. He guesses it's safe enough. Now, if he was to run the boiler himself, he wouldn't be anxious to save money on it, nor be satisfied of its soundness, without a critical examination by experts.

CORRESPONDENCE.

The Gay's River Conglomerates.

SIR,—I find a contribution in your last issue entitled, "Nova Scotia Gold Industry in 1891." Will you permit an appreciative reader of your REVIEW space to make reply to that portion of the article mentioned which relates to the Gay's River conglomerates. Allow me at the outset to explain that I was in charge of the prospecting operations there last summer, that I have taken a lively interest in the whole business, and am a large stockholder and one of the directors of the Coldstream Company that operated at Gay's River. That I am in a position to know can hardly be doubted; whether my education and intelligence and special knowledge have enabled me to make use of my opportunities, must be left to those who know me. I am bound to say that it is difficult to restrain a natural impatience, here, when a person who knows nothing of this particular locality comes forward to publish, and even, in print, so conspicuously to show what might have been avoided had he or some other competent individual been consulted. Without the slightest need of hesitation I set it down that this contributor has never made the acquaintance of the Gay's River conglomerates. The only key to the situation was the old mines, extending in nearly a horizontal direction 500 feet, and the explorations I made during the last summer. The old mines have been full of water for nearly twenty years, and until I pumped them dry, they could not be seen, and afterwards there was "no admission." The New York expert was on the ground a small portion of one day, all the time not out of my sight; he never saw the old works, and went away without the data to make a true report. The report which he *did* make lies at my hand now, and, although he (Hague), was at the top of his profession, there is not an attempt made to decide the nature and origin of the conglomerates, and he merely cites a report of *my own* as an adequate solution. At the time I wrote, there was no opportunity to enter the works at the points of decided interest, and *I made the mistake* of confounding *two* beds of conglomerate for *one*. In this direction I had some illustrious company, and among them the late Fred. Harte. I know now that at Gay's River we have a most interesting state of things. We have a river bed conglomerate, deposited in the Silurian slates and quartzites, and this formation is uniformly overlaid by a coarse and very hard sandstone, and the sandstone in turn is overlaid by a seashore conglomerate, capped by gravel. This lower conglomerate is gold-bearing. It varies in thickness from fourteen feet to nothing at all; this is due to two causes—one, the inequality of the rock river bed; the other, to the uneven surface upon which the sand was deposited.

The upper conglomerate contains varieties of rocks not found in the lower stratum, and contains either no gold or in very small quantities. In a shaft 40 feet through it I never found by panning a particle of gold. This ancient river encountered quartz veins and gold; when it began to run the slates and quartzites were already tilted and fissured to depths of several feet, and into these crevices coarse gold found its way, where the openings dipped down stream, but otherwise it did not. A ten stamp mill was run for seven years upon one area and a half, and although it was a crude affair, it took out gold enough to more than pay expenses. Enough is known to me to clearly demonstrate the existence of this river. The works thus far indicate a breadth of more than 500 feet—it may be much more. All the work that has been done on this river bed does not exceed the extracting of the ore from two areas, and yet I doubt not but it could be shown that the result in gold has paid for all the work ever performed within that limit. I have read in your REVIEW, issue of October, 1891, an address delivered in Halifax by Mr. Alfred Woodhouse, F.G.S., on "Nova Scotia Gold Fields," wherein he says: "I think Capt. McDuff will bear me out when I state that the great point to ascertain in connection with this, (viz., 'gold mining industry),' is to learn where are the beds of the old rivers, and I believe if properly looked for good alluvial fields will be eventually discovered in Nova Scotia."

For one to indulge in such a hope is, to the writer in your last issue, but "partial lunacy," for he says "The partial lunacy now prevailing as to the existence of alluvial gravels bearing gold in paying quantities will disappear, we predict, before our REVIEW for 1892 makes its appearance." Doctors disagree, as usual! Gay's river is what Mr. Woodhouse thinks worth looking for, and if the writer above had informed himself about the nature of it, he would never have fallen into the mistakes that I complain of here. The company spent a good deal of money in a very unwise and profitless manner. They were unduly influenced by men who like a "boom," provided that when it breaks they are the gainers; but it remains that the conglomerate in question is a deposit well worthy of further investigation, and its history might easily be equal to the best river bed mines of Australia. Of course I do not know how well equipped the expert might be who ventures to sit in judgment upon a property to which he is a stranger, but it would afford me much pleasure to compare notes with him in the hope that in the future he would confine himself to the good old-fashioned way of deducting conclusions from facts instead of fancies and prejudices.

ROBT. R. MCLEOD.

Brookfield, Queen's Co., Nova Scotia.

The Geological Survey Again—Some Pertinent Remarks on the New Map of Nova Scotia.

SIR,—The receipt of sheet 11 S.W. of the map of Nova Scotia, just issued by the Geological Survey Department confirms all the fears that have been expressed regarding the reduction of scale to four miles to the inch. One has only to look at this map sheet to realize how much valuable, painstaking labour, and how many important, economical data, are deliberately thrown away and lost forever by the stupid, crass obstinacy of the present Director and Deputy Head of the Department. One really wonders whether he has had the courage to take this sheet in one hand and one of the beautiful Cape Breton sheets in the other, and compare them. If any intelligent person will do so, and then admit that there is any basis for future usefuluess in the reduced sheet, we should be glad to have it pointed out.

When it is admitted that this small Province (17,500 square miles) contains one-tenth of the whole population of the Dominion, and produces about one-fourth or one-third of the total mineral and metallic yield of the Dominion, it is hard to conceive of the state of mind of that individual who can deliberately stultify the costly work of the past ten years, and issue such maps as are referred to. with the sole and only excuse of economy. And such a *miserably petty* economy !—the saving being only in the *hundreds* of dollars.

This same economist is the man who wrote in May,

1871 :* "The need of good topographical maps . . . . is well deserving the serious consideration of the Government. Such maps . . . . are indispensable, and *every dollar expended on their production eventually becomes an annual saving to the country.*" And yet, after having expended over $50,000 the past ten years in making just such "good topographical maps." it is now determined to save a few hundreds, and thereby make these maps anything but deserving of the above adjectives.

To the public interested in the mineral wealth of the country there will appear but one remedy for such a complete mental change, and that is—superannuation.

Yours respectfully,

JOHN E. HARDMAN.

Oldham Mines, Feb. 17th, 1892.

* Report of Progress, 1870-71.

LEGAL.

McIntosh vs. Stewart et al.

In this case, one of interest to phosphate miners, the plaintiff, John A. McIntosh, who resides at Toronto, claimed to recover from the defendants, Messrs. George Stewart of Buckingham and Alex. Spittal and Newell Bate (as an executor of the late C. T. Bate) of Ottawa, $3350 as commission on the sale of the High Falls Phosphate Mine, in the County of Ottawa, to The General Phosphate Corporation (Limited) of London, England. Judgment was given at Toronto recently by Mr. Justice Meredith, before whom the same was tried without a jury, at the York Assizes, last week, dismissing the plaintiff's action with costs. Messrs. Pearson & Macdonald of Toronto for the plaintiff. Mr. J. P. Fisher for the defendants Stewart and Spittal, and Messrs. Christie, Christie & Greene for the defendant, Bate.

Annual Meeting of the General Phosphate Corporation.

The adjourned ordinary general meeting of the shareholders of the General Phosphate Corporation, Limited, was held in London, the 20th. ult., Lord Stalbridge presiding.

The Secretary (Mr. L. J. Langmead) having read the notice convening the meeting,

The Chairman said : Gentlemen, I cannot, in opening the proceedings, do more than refer to the sad cloud which rests upon this nation to-day. When we fixed the date for this meeting we little thought that such an event would occur, and, doubtless, some of you, like myself, have been considering whether it would not be right and proper to adjourn the meeting. Looking, however, to the fact that it had already been adjourned, and that it was to be held in the middle of the day, we thought it would, perhaps, better meet the convenience of the gentlemen here if there were no adjournment, for, in any case, we would have to meet here. Therefore, we propose to go on with the business ; but I am sure that what is present to everybody's mind in this country to-day is also present to ours here, and that is the great loss which the nation has sustained. With regard to the report and balance-sheet, everything is, to the best of our belief, so clearly and accurately stated that I have little to add to them ; but perhaps I had better call your attention to certain points and amplify certain statements in the report. First of all, I should say that this meeting was adjourned to to-day from a date in December, as we were bound to hold it in the course of last year ; but the accounts had not come from Canada as we expected, and, therefore, it was necessary, that the meeting should be adjourned in order that those accounts should be put in proper order and laid before you. There is not much to be said in reference to the first paragraph in the report. As I have already said, the accounts were not ready, and this has caused delay in issuing them to the shareholders. With regard to the purchase of the two groups known as the High Falls and the Ross Mountain, doubtless every shareholder had a copy of Mr. Barthe's letter, and the directors' reply. The accusation, if I may call it so, made against us was that we had given too much money for those properties, and that they had been on the market in London at a lower price than the amount at which they were purchased by the corporation. We took every means in our power to ascertain the truth of those statements, and I think that the answers which were given by Mr. Colby and Mr. Stewart to the statements were the best means that we had of ascertaining the truth of the matter. I think the denials were so clearly put by those two gentlemen that we must believe that Mr. Barthe was under some misapprehension when he made those statements. I believe myself that there were some mistake in the property of Mr. Stewart to which Mr. Barthe refers, but nothing can be more categorical than the telegram which he sent, viz., "The claim you purchased from me was never offered in London as low as sold to you. Shareholders cannot prove to the contrary." Mr. Colby also gives a categorical denial to the statement in his case. Of course, it was an exceedingly difficult thing to purchase these properties at the price we should have liked ; but we acted upon the statement in the prospectus, that we would purchase no properties unless they were examined and reported upon by our own engineer.

The provisional contracts for the purchase of those properties were entered into in September, 1890, and we instructed two mining engineers, Mr. George Atwood and Mr. J. Lainson Wills, to examine and report upon them to the corporation, with the result that the engineers' reports furnished by the respective vendors were verified. We then engaged Mr. Lainson Wills as our representative in Canada, and he has been, and still is, our engineer in that country. He has carefully scrutinized every part of the working as far as lay in his power, and from time to time he has furnished us with reports of the workings and of the properties. Then a contract was entered into with Mr. Stewart to work the mines, and, by that contract, he engaged to deliver in Montreal 10,000 tons of phosphate at an average grade of 75 per cent. by May 1, 1892. That average was to be made up by not adding any phosphate of a lower grade than 70 per cent. Fifteen thousand pounds was to be provided by the corporation for plant and working capital, as that was the figure which Mr. Stewart thought necessary for that purpose. Well, then, certain mishaps occurred. It was found that there was a great deal more work to be done, owing to the virgin state of the properties, also that more had to be done in the way of providing buildings and accommodation for the men, and because of the fact of navigation being blocked, owing to the Canadian Government not having constructed in time the lock and dam across the river. It was known then that Mr. Stewart would be unable to fulfil his contract in the time from our point of view. Undoubtedly there would have been a long and expensive litigation if we had strictly adhered to the terms of the contract with Mr. Stewart. He asserted things on his side, and we asserted things on ours, and most undoubtedly there would have been a great deal of unnecessary delay and expense if we had strictly enforced the terms of our contract with Mr. Stewart. The directors, therefore, thought it advisable to act in a liberal spirit towards him, and a second agreement was drawn up, by which the previous one was extended for three months, namely, to August 1, 1892, and on condition of that Mr. Stewart surrendered £10,000 in cash, which was in the suspense account to be paid to him, and for surrendering that we agreed to pay him £1,000 in cash and 300 fully-paid shares of the corporation. He is now undertaking to complete the delivery of the before-mentioned 10,000 tons by August 1 next, when a further 500 shares will be issued to him, and he forfeits shares pro rata for every ton of phosphate not produced. We have no reason to complain of the quality of the phosphate which Mr. Stewart has sent over. The great bulk of it has been very high-grade phosphate indeed, and even on the lowest grade which has been sent over there is ample margin for a good profit, but, of course, nothing like so large a profit as what is made on the higher grades. This proves to us that we have got very valuable properties—that the phosphate is of very high quality—and I hope and believe that Mr. Stewart will complete his contract satisfactorily and finish the delivery of the 10,000 tons. Of course, none can be shipped till the spring, when it is hoped that the navigation of the Du Lievre River will be completed by the Canadian Government, and that then the scows will be able to bring it down to Buckingham, where there is railway communication to Montreal. The report shows you that Mr. Stewart has devoted his attention more to the High Falls Mine than to the Ross Mountain group. If he continues to work on the High Falls Mine, we shall be able later on to develop more fully the Ross Mountain group, which contains equally valuable phosphate, so that I have no doubt there will be ample for the future in both mines.

The directors, as you are aware, issued an appeal for more shares to be taken up. This was not responded to, and as it was necessary and advisable to have more working capital, and also to pay off the mortgages, the directors made arrangements with the Anglo-American Debenture Corporation to raise £100,000 of debentures. That money was raised, and in going through the accounts we will come to that point. Of course, the amount of phosphate which has been shipped is not large enough for us to declare a dividend now ; but, looking at the quality and the quantity pro rata of high-grade ore which has been shipped, we have every reason to be satisfied with the mines, and we believe that the output in future will fully realise our expectations. Now, if you will kindly take the balance-sheet in your hands, first of all you will see the capital, less the calls in arrear ; then the first mortgage bonds and the bills payable in London and Canada. I should say that the bills payable in London consist of the balance of bills for part purchase of the Colby property not yet due. Then there is the interest on debentures. That was the reserve taken up to October 31, which has been paid out since. The suspense account of £10,000 is the £10,000 which I alluded to as put on one side for payment to Mr. Stewart. The biggest item in the sundry creditors in London is the directors' fees, which they have not taken. They have had a small amount on account ; but the full amount which they are authorized to receive under the articles of association has not been drawn, and therefore, it is entered in the sundry creditors' account. The biggest item in the Canadian sundry creditors' account is an amount in adjustment with Mr. Stewart, which he claims, and which, like the mine expenditure, is subject to adjustment under Mr. Stewart's contract. Then, to go to the other side of the balance-sheet, you have the purchase of property, including experts' and surveyors' fees, interest and charges. A vast amount of that amount was paid off by the money from the Anglo-American Debenture Corporation. It was thought better to have that in one account rather than have these mortgages payable and due at uncertain times ; now we know with certainty when the amounts will fall due, and when we will have to pay for them. With reference to the North Star property deposit and expenses, I should like to mention that one of the objects of this corporation, besides working the properties themselves, was to develop and foster other properties, to help the formation of other companies, and with that view the North Star was taken up as being thought to be a useful and profitable investment. The object of the North Star Company, which has not been brought out yet, but which I hope will be brought out before long, is mainly devoted to the manufacture of super-phosphate. A very large house in New York are the proprietors of sulphuric acid works in Canada, and by those works, and by using the low-grade ore which is not worth while to ship to Europe, we believe a good profit can be made by making super-phosphate. We know that, as time goes on, virgin lands will be used up, and fertilisers will be required. That has been found to be the case to a great extent already in the United States, and there is no doubt that in the future there will be a greater demand for fertilisers than there has been hitherto. With sulphuric acid on the spot and low grade ore it is believed that a good profit can be made, and this corporation have taken up with another powerful finance corporation and the house in New York to which I have referred—the North Star property—with a view to the manufacture of super-phosphate. The registration fee was the only fee that we were called upon to pay for the formation of this company, with the exception of course, of the 200 fully-paid founders' shares issued to Mr. Sando, as the promoter of this company, by agreement. With regard to the London expenditure there is not much that calls for remark, but the shareholders may think that £15,526 was a high charge for the issue of the debentures. It undoubtedly was, but, unfortunately, we were unable to get it at a less cost. It was important to us to get the money, and, therefore, we were bound to pay that. With regard to the mine expenditure, those are the accounts which are still under adjustment with Mr. Stewart. Some of those accounts may turn out in his favour and some in ours. I must also allude to the note which has been added by the auditors. We regret as much as the auditors do that the accounts were not as well kept as we could have hoped. Our secretary (Mr. Langmead) went over to Canada himself last autumn and saw Mr. Stewart, and pointed out to him the way in which he would like the accounts kept and the way in which they should be presented ; but, unfortunately, they were not kept exactly in the way we hoped ; therefore, there has been a great deal of trouble in getting them straight ; but they are now straight, more or less, with the exception of certain adjustments, which remain to be dealt with hereafter. I do not know that there is any other point to which I need call your attention now, but, of course, I shall be glad to answer any question which any gentleman wishes to ask with regard to the accounts. I shall therefore conclude by moving the adoption of the report and accounts.

The Hon. Cecil T. Parker seconded the resolution.

Mr. Ferguson characterised the charge of £15,526 for the issue of the debentures as outrageous, and asked why, if money was absolutely necessary, the directors did not make a call on the 19,598 shares that had been issued.

The Chairman replied that the directors had great difficulty in getting the original calls, and when they had their first meeting they said they would do all that lay in their power to prevent a further call being made ; therefore they adopted the course of issuing debentures. He quite agreed with Mr. Ferguson that the charge was high, but they could not get it for less.

Mr. R. F. Crawley said that at the formation of the company an agreement was prepared which provided that if the directors did not go to allotment Mr. Sando was to get nothing, although he had incurred all expense of the formation of the company and advertising the prospectus. Mr. Sando failed to obtain from the public subscriptions for the full amount of founders' and ordinary shares, and, in order to persuade the directors to go to allotment, he found it necessary to subscribe for about 60 founders' shares and 3,000 ordinary shares, which was equal to £30,000. At a board meeting, in the absence, it was understood, of Lord Stalbridge, and against the protests of Sir James Whitehead and Mr. Sampson Lloyd, Mr. Sando and his friends persuaded the other directors to proceed to allotment.

The Solicitor remarked that Sir James Whitehead and Mr. Lloyd were present, and sanctioned the allotment and the arrangements under which Mr. Sando completed his guarantee before the issue of the prospectus to the public was made at the direct request of Sir James Whitehead himself.

Mr. Crawley : I apologise for having made that statement, if that is so. He proceeded to refer to the company's properties, and contended that they had been purchased at ridiculously high prices. With reference to the issue of debentures at a cost of £15,000, the obvious way of obtaining the money would have been to have made a call on the ordinary shareholders ; but this would not have suited Mr. Sando, who would have been called upon for about £12,000 in respect to the 3,000 ordinary shares standing in his name. As to the chairman of the company, if blame attached to him, it could only be because he had allowed himself to be hookwinked by the promoters. From the balance-sheet it appeared that in order to make £1 the directors had to spend £2 at the mines, in addition to the heavy London expenditure.

Mr. Smallman proposed as an amendment : "That a committee of five shareholders be appointed to investigate the affairs of the company and the purchase of the properties, and report to an adjourned meeting."

Mr. G. Barham seconded the amendment.

The Chairman said the board could not accept the

amendment, because everything had been placed before the shareholders in the reports and accounts.

Mr. J. Lainson Wills said he had made a careful examination of all the company's properties, and found that the supply of phosphate was inexhaustible. To make them a success it was only a question of working economically and on a large scale.

After some further discussion,

The Chairman expressed the hope that the shareholders would not check in any way the possibility of carrying on the company to a successful termination. The accounts applied to sixteen months, working, and a great many of the expenses would not occur again. If the directors had known that a call would have been successful, they would have made it instead of issuing debentures. All the directors had increased their holdings since the formation of the company.

The amendment, on being put, was lost, and the original resolution was carried.

On the motion of Mr. Hogarth, seconded by Mr. Smallman, the auditors (Messrs. Deloitte, Dever, Griffiths & Co.) were re-elected.

Mr. Barham proposed a vote of thanks to the chairman.

This was seconded by Mr. Grantham, and carried unanimously.

The proceedings then terminated.

The British and European Phosphate Market in 1891.

The following report has been issued by the Anglo-Continental Guano Works Co. of London :—

"We beg to append table giving the quantities and origin of the phosphates imported into the United Kingdom during the last five years.

There has been a serious falling off in the quantities imported, amounting to 86,729 tons as compared with 1890, and to 48,181 tons as compared with 1889.

Already during the first half-year we reported a reduction in the importations, and the decrease has continued to the end of the year, and seems to have been spread over all the important ports alike.

The deficiency is probably due not only to a smaller demand for phosphatic manures, but also to the heavy stocks left over from the previous year, when importations were evidently in excess of requirements.

In consequence of the interruption of production on the Coosaw river the quantities received from South Carolina were only 97,000 tons, but the shortage was partly made good by the supply from Peace river and other Florida phosphate mines. This pebble phosphate from Peace river has found ready buyers as it is even preferred to Bull river phosphate.

A considerable change has taken place in our supply of high-class phosphates containing 70% of phosphate of lime and over. Only about 10,000 tons of phosphates arrived from Aruba and Sombrero last year, against respectively 16,000 and 19,000 tons in 1889 and 1890.

The supply from Florida was 35,203 tons, of which about 16,000 tons were river phosphates from Peace river and one cargo from Alafia river. Part of the high grade Phosphate from Florida was re-shipped to the Continent, like most of the Canadian phosphate which arrives in this conntry.

The consumption of high-grade phosphates in the United Kingdom will therefore not have exceeded about 50,000 tons last year.

Considerably less Somme and Belgian phosphates have been used, especially if we consider that in the quantity of phosphates from Belgium, a large quantity of Osso phosphate from the new mines near Liège is included.

Although the production on the Coosaw river was interrupted last year it appears that South Carolina produced more phosphate than ever, the consumption in the United States evidently increasing rapidly.

The following are the figures of the last three years :—

	Tons.
1889	462,101
1890	537,149
1891, about	600,000

During 1889-90, from September 1st to August 31st,
219,822 tons were shipped to Europe from Charleston and Beaufort.
250,936 tons were sent inland by rail and coastwise.
116,000 " " consumed locally.

586,758 "

showing that whilst about 220,000 tons, mostly river phosphates, are sent from South Carolina to Europe, the remainder is consumed in the United States.

The production in Florida last year began to assume large proportions, as will be seen from the appended statement recently published in the *Manufacturers' Record.*

Calculated at the present rate of production, Florida would furnish about 100,000 tons of river (pebble) phosphates and about 100,000 tons of high-class land rock with perhaps some low-class land phosphates for home consumption.

It is, however, impossible to estimate future production with any degree of certainty, because the mines inland are only partially developed, and some are still waiting the completion of railway connections, whilst other large mines work at reduced speed, or not at all, on account of the present low prices of phosphates in Europe.

The sanguine hopes of the many miners in Florida are not likely to be realized, because it costs more to raise saleable phosphates than they expected, and there is no possible sale for large quantities of high-class phosphates in Europe.

In the Somme District in France, raisers of phosphates have suffered under the serious fall in prices, caused by the new discoveries in Florida, and the production last year was probably on a somewhat smaller scale than the previous year. As regards cost of raising, preparing for and bringing into the market, the Somme raisers are much better placed than any other miners; but many properties in the Somme were acquired at such a high cost that the present reduced prices must be very unremunerative to them.

We have not yet received exact figures of last year's production in France, but give the following figures of previous years :—

In 1889 the quantity of phosphates produced in the Somme was stated to have been about 260,000, tons of which about 100,000 tons were of high-grade, say 65/80%.

In 1890 the production in the Somme has been stated as 250,000 tons, of which about 120,000 tons were exported.

The export of phosphates from France was :

	Tons.
1887	50,898
1888	99,673
1889	150,963
1890	122,002

During the past year (1891) the quantity of Somme phosphates exported from France must have been much smaller, as is evident from the quantities landed in the United Kingdom and Germany; but the home consumption in France seems to be increasing, and a large quantity of low-class ground phosphates is used by the French farmers direct without manufacture into superphosphate.

We have not yet been able to obtain particulars of the quantity of phosphate raised last year in Belgium, but it seems clear that the production of calcareous phosphate near Mons is not much increasing, whilst the old mines near Mons are about worked out. The new mines near Liège are in full activity, and although the quantity raised will be much less than expected, still the production will be important for some years to come.

Germany has always been the best market for high class phosphates, and consequently the new Florida phosphate has been most extensively used in that country. We have particulars of imports during last year only from two ports, which of course are no indication of the total quantity used in Germany, but are characteristic as to the origin of the material, and may be summarized as follows :

	Tons.
South Carolina	13,022
Peace River (Florida)	7,540
Florida land rock	20,455
Somme phosphates	5,803
Canadian	4,210
Aruba Curaçoa	970
	52,000

We estimate the present production and consumption of phosphates in the entire world as stated below. We give at the same time the proportion of high class phosphates used in the various countries, which do not amount to more than from 200,000 to 250,000 tons annually."

Importation of Phosphates into the United Kingdom, Indicating Countries of Production.

Country whence Imported.	1887. Tons.	1888. Tons.	1889. Tons.	1890. Tons.	1891. Tons.
U. S. of America	165,275	111,369	122,154	177,283	Florida....35,203 S. Carolina. 96,881
British West Indies	6,451	11,010	1,880	3,970	1,960
Dutch West Indies	9,505	10,736	14,730	14,763	8,861
Hayti and San Domingo	3,044	6,238	4,094	992	1,639
Venezuela and Guiana	405	.....	.....	.....	540
Brazil	1,200	.....	.....	.....	. . ..
Australia	350	.....	1,250	.....	.. ...
British N. America	19,194	12,423	23,297	21,089	15,918
Portugal	15,612	6,978	1,326	.....	320
France	11,140	39,059	65,490	35,659	18,325
Belgium	45,322	54,261	64,643	82,096	70,723
Holland	4,778	4,137	2,270	2,428	3,434
Other Countries	1,139	1,675	390	1,070	1,483
Norway	.....	.....	.....	4,151	1,495
Total	283,415	257,886	304,953	343,501	256,772

Exports of Phosphates.

Sweden	.....	.....	1,305	1,587	.... .
Germany	7,034	3,747	9,716	6,235	.....
Holland	1,443	985	1,535	.....	.....
Other Countries	1,609	891	1,510	489	.....
Total Export	10,086	5,623	14,066	8,311	.....
Remaining for U. K	273,329	252,263	290,887	335,190	.....

Summary of Production of Phosphates.

	Tons.
South Carolina	600,000
Florida, land rock	100,000
" river "	100,000
France	450,000
Belgium	200,000
Canada	15,000
England	20,000
Germany	40,000
Norway, Russia, and other countries, say	100,000
	1,625,000

Summary of Consumption of Phosphates.

	Tons.	Of which high-grade over 70% Tons.
United States	500,000	10,000
United Kingdom	300,000	50,000
Germany	250,000	100,000
France	200,000	30,000
" used in raw state	150,000	.....
Belgium and Holland	75,000	15,000
Italy, Spain, Sweden, and other countries	150,000	20,000
	1,625,000	225,000

Florida Phosphates.

Pebble Phosphates :—

	Tons.
Shipments from Punta Gordia from 1889, to September 1st, 1891 (official)	42,210
September 1st to 14th December, 1891 (official)	27,065
December 14th to 31st December (estimated).	5,725
	75,000
From Alafia River, Tanipa (estimated)	10,000
From Barton, North, by rail (official), up to September 1st, 1891	32,088
From September 1st to 31st December (estimated)	9,012
From Black River *via* St. John's River (estimated)	8,000
Total pebble output	134,100

Hard Rock Phosphates :—

Up to September 1st, 1891, by rail		63,198
Of which		
Fernandina received to September 1st		47,760
September 1st to November 20th		6,451
Remainder of year (estimated)		9,789
Total at Fernandina		64,000
Received at other places up to September 1st	17,438	
To 31st December (estimated)	7,562	
		25,000
Exported from Port Tampa to November 20th, 1891	18,200	
To 31st December (estimated)	5.800	
		24,000
Total hard rock		113,000

Recapitulation.

Pebble phosphates	134,000
Hard rock phosphates	113,000
Total estimated shipments	247,000
During 1891	186,000

Improvements in Methods of Prospecting Mineral Lands.

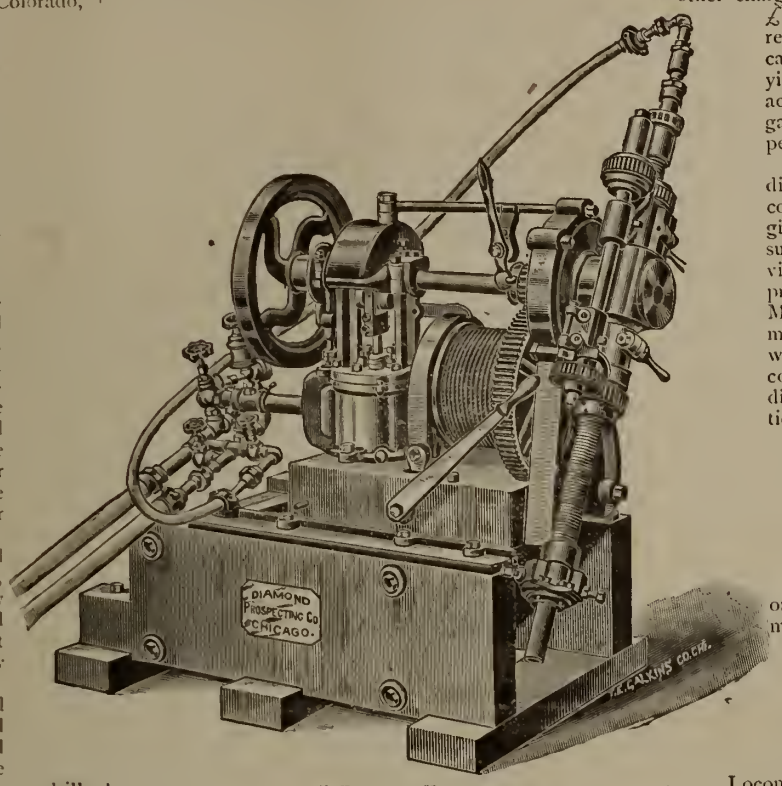
One of the most interesting features of the advancement in mining processes is the constantly increasing use of the diamond drill for prospecting mineral lands and developing mines. By means of the solid core of rock and minerals removed by the diamond drill, a knowledge of mineral property can be obtained equal to that gained by a large number of shafts, tunnels and cross-cuts; and as the cost per foot of drilling is trifling compared with that of shaft-sinking, tunnelling and cross-cutting, and its progress so much more rapid, the tendency is, by its use, to explore properties more thoroughly before opening them up, and more completely while developing them, thus reducing considerably the element of uncertainty connected with the old method of prospecting.

The increasing favor in which the diamond drill is held among mining men is especially marked in Colorado, where twenty-five or thirty leading mining companies have purchased "Sullivan" diamond drills within the last two or three years, to be used in formations where it was formerly supposed they could not be used to advantage. Several remarkably rich discoveries of ore have been made in Colorado with the "Sullivan" drill, as at Aspen, Leadville and Red Mountain.

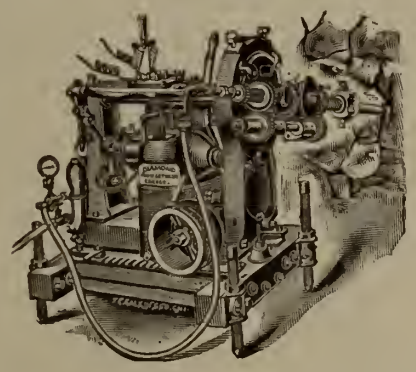
As the use of the diamond drill has been extended to all branches of prospecting work, new styles have been built to meet new requirements. The latest "Sullivan" diamond prospecting core drill, is shown in the accompanying cut of the "S" drill, fig 1. This drill is designed for either surface or underground work, and will be found especially convenient where it can be used for examining new property, and afterward for developing the mine and locating new ore bodies. It has a hoist and frame, for convenience in surface work, and the "friction" feeding device, used on some other types of Sullivan diamond drills, which is the safest, most economical, and most compact for use in underground work.

Another recent design of the Sullivan diamond drill is shown in the small cut of the "R" drill, fig. 2, operated by electricity. This is the only electric diamond drill in practical and successful operation, several of the best equipped mines at Aspen, Colo., and other western camps, now using them with very satisfactory results.

These machines, and other Sullivan diamond drills of all kinds, are sold by the Diamond Prospecting Co., whose main office is at 15 and 17 N. Clinton st., Chicago, with western office at 18th and Market Sts, Denver, Colo., where drills can be seen in stock.



"S" Drill.—Fig. 1.



"R" Drill—Fig. 2.

Something New in Quartz Crushing Machinery.

A new Australian process of quartz crushing is described in a recent issue of the *Ballarat Courier*. Our contemporary says:—The Mudie Brothers, of Elaine, have been for some time perfecting a machine which promises to revolutionize present appliances, insomuch as it lowers the cost of treatment, pulverises to a greater fineness, and grants facilities for a more thorough amalgamation of the gold. The works are situated near the north end of that line of Elaine gold bearing reefs, the trend of which is marked by the mullock heaps of the now defunct mines. The Mudie patent is remarkable for its simplicity, and the appliance it is claimed banishes at once any necessity for a precise adjustment of parts, and the great wear and tear usually found in all pulverisers, outside of the ordinary gravitation stamper. It is simply an iron cradle. For the sake of illustration, take an ordinary steam boiler, say 7 feet long and 2 feet wide, and have it cut in two—lengthways. Then take one half and have some inch angle iron run across its bottom at 2 feet intervals. In these intervals place rollers, shaped like a large cheese, say 1 foot wide and 1 foot 6 inches in diameter. Below each roller, which occupies 1 foot in 2 foot space, have quicksilver ripples in the curve of the bottom, and below these a grating—after the first roller (say), 30 holes to the inch, the second 80, the third 200, and so on. The greater the number of rollers, the finer the pulverising. In the toe of the cradle have three or four ripples. The iron cheese-shaped rollers are very heavy, being about half a ton each. In Mudie's machine there is about 2 inches difference in the bed levels of the different rollers, and it was very surprising to note the ease with which one man could set the affair in motion, a motion which centred the effects of gravitation, momentum, and the rebound of the rollers on to the quartz, as the water and the rocking bore it along under the different rollers through the silver and the gratings. It was also very surprising to note how thoroughly agitated the quicksilver became, as it swung backwards and forwards with each roll of the cradle. With a short lever handle one man could work the machine, and Mr. Mudie's estimate is that it will put through 25 tons per week. The whole affair appeared to be perfection itself, offering the maximum facility in return for the minimum effort, both in pulverising and amalgamating. A horse would work six of them, and (according to Mr. David Mudie's calculations) could get through over 100 tons per week. Of course the ordinary tables or a Frue vanner could be fitted to it, but that would be decided by the nature of the material to be operated on. As far as Mudie's plant is concerned, everything was in a very crude state, although they have one machine in going form. As with inventive genius all the world over it has been a struggle for them, intensified by want of means, and aggravated by the jeers of the unsympathetic. Patient endurance and continuity of purpose have, however, brought them through, and they have succeded in perfecting a machine that will enable a small co-operative party to crush 25 tons per week with the aid of one man and a boy (using one machine) or a company to crush over 1200 tons by putting an eight-horse power engine on 50 of them. It is simplicity itself, both in construction, and its mode of action. It requires very little building in, and a child could manage it when in motion. The slightest force keeps its pendulum-like swing going, and it is claimed, the *Ballarat Courier* adds, that the Mudie Brothers have really hit on a most efficient, while exceptionally economical application of power, in association with the desired facilities for gold saving.

The Cost of Producing Coal in England.

The British Board of Trade has just published a report relative to the percentages of raw material, wages, other expenses and profit, bear to cost of product in the leading industries of Great Britain. The sources of the information on which this report is based are Parliamentary publications and the reports of joint stock companies. The industries discussed that are of interest to our readers are coal mining, iron and steel manufacturing, and shipbuilding and engineering. In this connection we propose to discuss the facts given in connection with the first-named industry—coal mining.

The items as to the expenditure incurred in the production of coal are from the evidence taken by the Royal Commission in Mining Royalties. The evidence of five witnesses are summarized as follows. This includes only cost:—

	Mr. Hewlett. (Wigan.)	Mr. Brown. (South Wales.)	Mr. Vickerman. (Pembroke.)	Mr. Cowey. (Yorkshire.)	Mr. Barnes. (South Wales.)
	%	%	%	%	%
Wages	62.39	65.34	65.59	66.67	65.95
Royalties	9.22	8.58	7.53	12.74	11.72
Other charges	28.39	26.08	26.88	20.59	22.33
	100.00	100.00	100.00	100.00	100.00

Mr. Hewlett is the well known manager of the Wigan Coal and Iron Company, Mr. Brown is a mining engineer, Mr. Vickerman is a proprietor, Mr. Barnes is one of the owners of the Coalbrook Collieries, while Mr. Cowey represented the Yorkshire Miners' Association. The figures given by the five gentlemen named, and others that appear in the report, cover the annual production of millions of tons.

It is pointed out in the report that the proportion of the product directly expended in wages varies from 48 to 59.4 per cent.; that the other expenditure, including the royalties which are not always separately distinguished, ranges from 27.1 per cent. to 46.5 per cent., and that what is termed the balance of trading profit is in one case as low as 5 per cent., and in another as high as 27.1 per cent. By aggregating the five undertakings out of a total value of product of £739,915, almost one-half, or £370,251, is expended in wages, and £280,407, or 43.1 per cent., in other charges, leaving a balance of so-called profit of £89,257, or 12.06 per cent. of the product, to remunerate a total capital of £1,397,502. This capital is, however, partly, invested in property yielding an income of £20,900 apart from the actual produce of the mines, so that the aggregate income for the year was £110,157, or 7.88 per cent. of the capital employed.

The report states: Opinions would probably differ, within certain limits, as to the general conclusions to be drawn from the information given, and the materials ought in any case to be supplemented by others before any but a very provisional estimate of the distribution of the whole product could be made. The figures supplied by Mr. Hewlett are those which could, perhaps, be most safely taken as typical of the industry as a whole, and on such a basis the whole product of coal in Great Britain, of the year 1889 would be divisible in something like the following proportions:—

Wages, 55%	£30,896,250
Royalties, 8%	4,494,000
Other charges, 25%	14,043,750
Profits, 12%	6,741,000
	£56,175,000

Mr. Hewlett's statement of actual costs for the one-half year ending Dec. 31, 1889, at the Arley mine of 10 pits, are as follows:—

	s.	d.
Average prices of coal	6	5.1
Total wages	3	5.8
Royalty		6.5
Materials	0	5.7
Boiler coal	0	2.8
Locomotive charges	0	2.3
Horses	0	0.2
General charges	0	3.7
Depreciation	0	4.7
Salary	0	1.5
Total	1	8.9
Total	5	9.2
Profit to lessee		7.9

Regarding the general table given above of the whole production of 1889, it is noted that the figures thus arrived at very possibly fall short of the facts as regards the amount devoted to wages, and, *per contra*, somewhat overstate the amount of profits. But, as regards the first point, it is to be remembered that the amount paid directly for labor requires to be supplemented by a certain proportion, not less than one-fourth, of the other charges, which indirectly include payments for wages, and with regard to the amount of profit, it is also to be borne in mind that the figures given represent the results of a very good year. Some information has already been given as to the difference between the effects of a change of price upon the earnings of the workmen and the profits of the mineowner. "The labor receives an exceptionally large share when the prices are low, in consideration of taking the smaller share when prices are high;" whilst, on the other hand, "the lessee who has to pay higher wages than he economically ought to pay when prices are low, is recouped when prices are high."

Depths of Some Butte, Montana Properties.—For the purpose of giving those not familiar with the mines of Butte an idea of the depths to which a few of the more important properties here are being worked, the following figures have been prepared: Alice, 1,500 feet; Lexington, 1,465; Anaconda, 1,000; St. Lawrence, 1,000; Mountain View, 1,000; Gagnon, 1,000; Mountain Consolidated, 800; Moulton, 800; Parrot, 800; Blue Wing, 700; Magna Charta, 600; Rising Star, 600; Silver Bow, 700; East Gray Rock, 800; West Gray Rock, 500; Belle of Butte, 500; Parrot Colusa, 500; Ramsdell Parrot, 600; Amy and Silversmith, 500; Rarus, 600; East Colusa, 500; West Colusa, 500 (new shaft 600); Blue Bird, 700; Matte, 500; Harris Lloyd, 500; Speculator, 400; High Ore, 600; Wake-Up-Jim, 500; Green Mountain, 500; Original, 500. Outside of these there are at least 60 more, the depth of which varies from 100 to 400 feet and from which ore in abundance is being extracted. The Ground Squirrel, which is already one of the largest copper ore producers in the camp, has a shaft only 200 feet in depth. The output from this property alone is about 4,000 tons per month.—*Miner.*

Modern Methods of Quarrying.

Mr. Wm. L. Saunders, for many years the engineer of the Ingersoll Rock Drill Company, and hence thoroughly familiar with modern quarrying practice, read a paper recently before the American Society of Civil Engineers on the above subject, containing many interesting points, which we abstract as follows.

As a preliminary to describing the new Knox system of quarrying, which even yet is not universally known among quarrymen, Mr. Saunders gives the following in regard to other methods :

The Knox system is a recent invention ; no mention was made of it in the tenth census, and no description has yet been given of it in any publications on quarrying. The first work done by this method was in 1885, and at the close of that year two quarries had adopted it. In 1886 it was used in 20 quarries ; in 1887 in 44, in 1888 in upward of 100, and at the present time about 300 quarries have adopted it. Its purpose is to release dimension stone from its place in the bed, by so directing an explosive force that it is made to cleave the rock in a prescribed line without injury. The system is also used for breaking up detached blocks of stone into smaller sizes.

Quarrymen have, ever since the introduction of blasting, tried to direct the blast so as to save stock. Holes drilled by hand are seldom round. The shape of the bit and the irregular rotation while drilling usually produce a hole of somewhat triangular section. It was observed, many years ago, that when a blast was fired in a hand drilled hole, the rock usually broke in three directions, radiating from the points of the triangle in the hole. This led quarrymen to look for a means by which the hole might be shaped in accordance with a prescribed direction of cleavage.

Fig. 1.

The oldest sandstone quarries in America are those at Portland, Conn. It was from these quarries that great quantities of brownstone were shipped for buildings in New York. The typical "brownstone front" is all built of Portland stone. As the Portland quarries were carried to great depths the thickness of bed increased, as it usually does in quarries. With beds from 10 to 20 feet deep, all of solid and valuable brownstone, it became a matter of importance that some device should be applied which would shear the stone from its bed without loss of stock and without the necessity of making artificial beds at short distances. A system was adopted and used successfully for a number of years which comprised the drilling of deep holes from 10 to 12 ins. in diameter, and charging them with explosives placed in a canister of peculiar shape. The drilling of this hole is so interesting as to warrant a passing notice. The system was similar to that followed with the old-fashioned drop drill. The weight of the bit was the force which struck the blow, and this weight was simply raised or lowered by a crank, turned by two men at the wheel. The bit resembled a broadaxe in shape, in that it was extremely broad, tapering to a sharp point and convex along the edge.

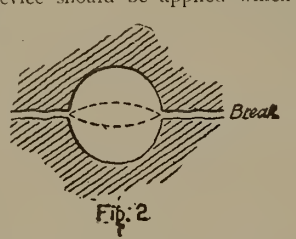


Fig. 2.

Fig. 1 illustrates in section one of the Portland drills, and a drill hole with the canister containing the explosive in place. The canister was made of two curved pieces of sheet tin with soldered edges, cloth or paper being used at the ends. It was surrounded with sand or earth, so that the effect of the blast was practically the same as though the hole was drilled in the shape of the canister. In other words, the old Portland system was to drill a large, round hole, put in a canister, and then fill up a good part of the hole. Were it possible to drill the hole in the shape of the canister, it would obviously save a good deal of work which had to be undone. The Portland system was, therefore, an extravagant one, but the results accomplished were such as to fully warrant its use. Straight and true breaks were made, following the line of the longer axis of the canister section, as in Fig. 2.

It was found that with the old Portland canister two breaks might be made at right angles by a single blast, when using a canister shaped like a square prism. In some of the larger blasts, where blocks weighing in the neighborhood of 2,000 tons were sheared on the bed, two holes as deep as 20 feet were drilled close together. The core between the holes was then chipped out and large canisters measuring two feet across from edge to edge were used.

In regard to another of the older systems of blasting, known as Lewising, Mr. Saunders says :

"A Lewis hole is made by drilling two or three holes close together and parallel to each other, the partitions between the holes being broken down by using what is known as a broach. Thus a wide hole or groove is formed in which powder is inserted, either by ramming it directly in the hole, or by putting it in a canister, shaped somewhat like the Lewis hole trench. A complex Lewis hole is the combination of three drill holes, while a compound Lewis hole contains four holes. Lewising is confined almost entirely to granite. In some cases a series of holes is put in along the bench at distances of 10 and 25 feet apart, or even greater, each Lewis hole being situated equi-distant from the face of the bench. The holes are blasted simultaneously by an electric battery."

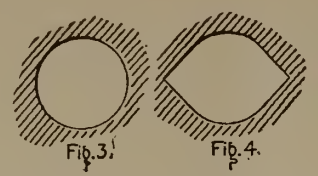


Fig. 3. Fig. 4. Fig. 5.

After noting another system used to a limited extent, and not to be commended, viz., the use of inverted plugs and feathers (the plugs and feathers being inserted as a sort of tamping, which the blast drives upward to split the rock), Mr. Saunders continues in substance as follows :

"It is thus seen that the 'state of the art' has been progressive, though it was imperfect. Mr. Sperr, in his

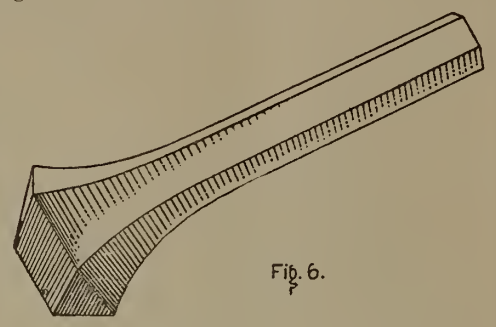


Fig. 6.

reference to this subject, made in the report of the tenth census, says : 'The influence of the shape of the drill hole upon the effects of the blast does not seem to be generally known, and a great waste of material necessarily follows.' This was written but a few years before the introduction of this new system, and it is doubtless true that attention was thus widely directed to the conspicuous waste, due to a lack of knowledge of the influence of the shape of a drill hole on the effect of a blast. The system developed by Mr. Knox practically does all and more than was done by the old Portland system, and it does it at far less expense. It can best be described by illustrations.

Fig. 7.

Fig. 3 is a round hole drilled either by hand or otherwise, preferably otherwise, because an important point is to get it round. Fig. 4 is the improved form of hole, and this is made by inserting a reamer, Figs. 5 and 6, into the hole in the line of the proposed fracture, thus cutting **V**-shaped grooves into the walls of the hole. The blacksmith tools for dressing the reamers are shown in Fig. 7. The usual method of charging and tamping a hole in the new system is shown in Fig. 8. The charge of powder is shown at *C*, the air-piece at *B*, and the tamping at *A*. Fig. 9 is a special hole for use in thin beds of rock. The charge of powder is shown at *C*, the rod to sustain tamping at *D*, air-space at *BB*, and tamping at *A*.

Let us assume that we have a bluestone quarry, in which we may illustrate the simplest application of the new system. The sheet of stone which we wish to shear from place has a bed running horizontally at a depth of

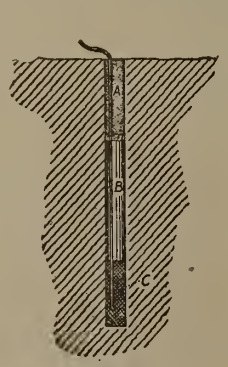


Fig. 8.

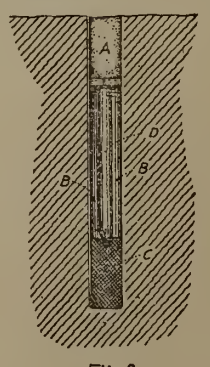


Fig. 9.

say 10 feet. One face is in front, and a natural seam divides the bed at each end at the walls of the quarry. We now have a block of stone, say 50 feet long, with all its faces free except one—that opposite and corresponding with the bench. One or more of the specially formed holes are put in at such depth and distance from each other and from the bench as may be regulated by the thickness, strength and character of the rock. No man is so good a judge of this as the quarry foreman who has used and studied the effect of this system in his quarry. Great care should be taken to drill the holes round and in a straight line. In sandstone of medium hardness these holes may be situated 10, 12 or 15 feet apart. If the bed is a tight one, the hole should be run entirely through the sheet and to the bed ; but with an open free bed holes of less depth will suffice.

The reamer should now be used and driven by hand. Several devices have been applied to rock drills for reaming the hole by machinery while drilling ; that is, efforts have been made to combine the drill and the reamer. Such efforts have met with only partial success. The perfect alignment of the reamer is so important that where power is used this point is apt to be neglected. It is also a well known fact that the process of reaming by hand is not a difficult or a slow one. The drilling of the hole requires the greatest amount of work. After this has been done it is a simple matter to cut the **V**-shaped grooves. The reamer should be applied at the center, that is, the grooves should be cut on the axis, or full diameter of the hole. The gauge of the reamer should be at least 1½ diameters. Great care should be taken that the reamer does not twist, as the break may be thereby deflected ; and the reaming must be done also to the full depth of the hole.

The hole is now ready for charging. The powder should be a low explosive, like black or Judson powder, or other explosives which act slowly. No definite rule can be laid down as to the amount of powder to be used, but it should be as small as possible. Very little powder is required in most rocks. Hard and fine grained stone requires less powder than soft stone. Mr. Knox tells of a case which came under his observation, where a block of granite 'more than 400 tons weight split clear in two with 13 ozs. of FF powder.' He compares this with a block of sandstone of less than 100 tons weight 'barely started with 2½ lbs. of the same grade of powder, and requiring a second shot to remove it.'

It is obvious that enough powder must be inserted in the hole to produce a force sufficient to move the entire mass of rock on its bed. In some kinds of stone, notably sandstone, the material is so soft that it will break when acted upon by the force necessary to shear the block. In cases of this kind a number of holes should be drilled and fired simultaneously by the electric battery. In such work it is usual to put in the holes only 4 or 5 feet apart. The powder must, of course, be provided with a fuse, or preferably a fulminating cap. It is well to insert the cap at or near the bottom of the cartridge, as shown in Figs. 8 and 9.

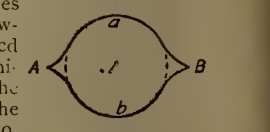


Fig. 10.

After the charge the usual thing to do is to insert tamping. In the improved form of hole the tamping should not be put directly upon the powder, but an air space should be left, as shown at *B*, Fig. 8. The best way to tamp, leaving an air space, is first to insert a wad, which may be of oakum, hay, grass, paper or other similar material. The tamping should be placed from 6 to 12 ins. below the mouth of the hole. In some kinds of stone a less distance will suffice, and as much air space as practicable should intervene between the explosive and the tamping. If several holes are used on a line they should be connected in series and blasted by electricity. The effect of the blast is to make a vertical seam connecting the holes, and the entire mass of rock is sheared several inches or more.

The philosophy of this new method of blasting is simple, though a matter of some dispute. The following explanation has been given. See Fig. 10 :

'The two surfaces, *a* and *b*, being of equal area, must receive an equal amount of the force generated by the conversion of the explosive into gas. These surfaces being smooth and presenting no angle between the points *A* and they furnish no starting point for a fracture, but at these points the lines meet at a sharp angle including between them a wedge-shaped space. The gas acting equally in all directions from the centre is formed into the two opposite wedge-shaped spaces, and the impact being instantaneous the effect is precisely similar to that of two solid wedges driven from the centre by a force equally prompt and energetic. All rocks possess the property of elasticity in a greater or less degree, and the principle being excited to the point of rupture at the points *A* and *B*, the gas enters the crack and the rock is split in a straight line, simply 'because under the circumstances it cannot split in any other way.'"

Another theory which is much the same in substance is then given, and after some general discussion of the theory of the action of the forces under the several systems, the paper continues :

"The new form of hole is, therefore, almost identical in principle with the old Portland canister, except that it has the greater advantage of the **V**-shaped groove in the rock, which serves as a starting point for the break. It is also more economical than the Portland canister in that it requires less drilling and the waste of stone is less. It is, therefore, not only more economical than any other system of blasting, but it is more certain, and in this respect it is vastly superior to any other blasting system, because stone is valuable, and anything which adds to the certainty of the break also adds to the profit of the quarryman.

It is doubtless true that, notwithstanding the greater area of pressure in the new form of hole, the break would not invariably follow the prescribed line but for the **V**-shaped groove, which virtually starts it. A bolt, when strained, will break in the thread whether this be the smallest section or not, because the thread is a starting point for the break. A rod of glass is broken with a slight jar provided a groove has been led in its surface. Numerous other instances might be cited to prove the value of the groove. Elasticity in rock is a pronounced feature, which varies to a greater or less extent ; but it is always more or less present. A sandstone has recently been found which possesses the property of elasticity to such an extent that it may be bent like a thin piece of

steel. When a blast is made in the new form of hole the stone is under high tension, and being elastic it will naturally pull apart on such lines of weakness as grooves, especially when they are made, as is usually the case with this system, in a direction at right angles with the lines of least resistance.

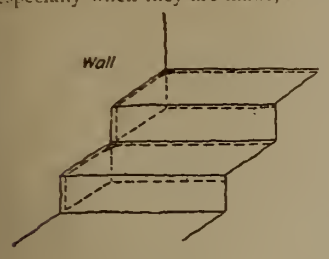


Fig. 11.

Horizontal holes are frequently put in and artificial beds made by "lofting." In such cases where the rock has a "rift" parallel with the bed, one hole about half way through is sufficient for a block about 15 feet square, but in "liver" rock the holes must be drilled nearly through the block and the size of the block first reduced.

A more difficult application of the system, and one requiring greater care in its successful use, is where the block of stone is so situated that both ends are not free, one of them being solidly fixed in the quarry wall. A simple illustration of a case of this kind is a stone step on a stairway which leads up and along a wall, Fig. 11. Each step has one end fixed to the wall and the other free. Each step is also free on top, on the bottom and on the face, but fixed at the back. We now put one of the new form of holes in the corner at the junction of the step and the wall. The shape of the hole is as shown in Fig. 12.

It is here seen that the grooves are at right angles with each other, and the block of stone is sheared by a break made opposite and parallel with the bench, as in the previous case, and an additional break made at right angles with the bench and at the fixed end of the block. Sometimes a corner break is made by putting in two of the regular **V**-shaped holes in the lines of the proposed break and without the use of the corner hole. A useful application of this system is in splitting up large masses of loose stone. For this purpose the **V**-shaped grooves are sometimes cut in four positions and breaks are made in four directions radiating from the centre of the hole as shown in Fig. 12. In this way a block is divided into four rectangular pieces.

Fig. 12.

Though the new system is especially adapted to the removal of heavy masses of rock, yet it has been applied with success in cases where several light beds overlie each other. In one such instance 10 sheets, measuring in all only 6 ft., were broken by a blast, but in cases of this kind the plug and feather process applies very well, and the new system, when used, must be in the hands of an expert, or the loss will ne serious.

Referring again to our stone step, let us imagine a case where this stairway runs between two walls. We have here each step fixed at each end and free only on the top, the bottom, and one face. Let us assume that there is a back seam, that is, that the step is not fixed at the back. In a quarry, this seam, unless a natural one, should be made by a channeling machine. In order to throw this step out of place it must be cut off at both ends, and for this purpose the **V**-shaped holes are put in at right angles to the face. It is well, however, to put the first two holes next the back seam in a position where the grooves will converge at the back so as to form a sort of key which serves a useful purpose in removing the block after the blast. In quarries where there are no horizontal beds, a channeling machine should be used to free the block on all sides and to a suitable depth, and then the ledge may be "lofted" by holes placed horizontally.

Where "pressure" exists in quarries, the new system has certain limitations. After determining the line of "pressure" it is only practicable to use the system directly on the line of thrust, or at right angles to it. It is much better, however, to release the "pressure" from the ledge by channeling, after which a single end may be detached by a Knox blast. It is well to bear in mind that the holes should invariably be of small diameter. In no case should the diameter of hole be over 1½ in. in any kind of rock. This being the case, the blocks of stone are delivered to the market with but little loss in measurement. It is a noticeable fact that stone quarried by the new system shows very little evidence of drill marks, for the faces are frequently as true as though cut with a machine.

A further gain is the safety of the system. The blasting is light and is confined entirely within the holes. No spalls or fragments are thrown from the blast.

The popular idea that the system is antagonistic to the channeling process is a mistaken one. There are, of course, some quarries which formerly used channeling machines without this system, but which now do a large part of the work by blasting. Instances, however, are rare where the system has replaced the channeler. The two go side by side, and an intelligent use of the new system in most quarries requires a channeling machine. There are those who may tell of stone that has been destroyed by a blast on the new system, but investigation usually shows that either the work was done by an inexperienced operator, or an effort was made to do too much.

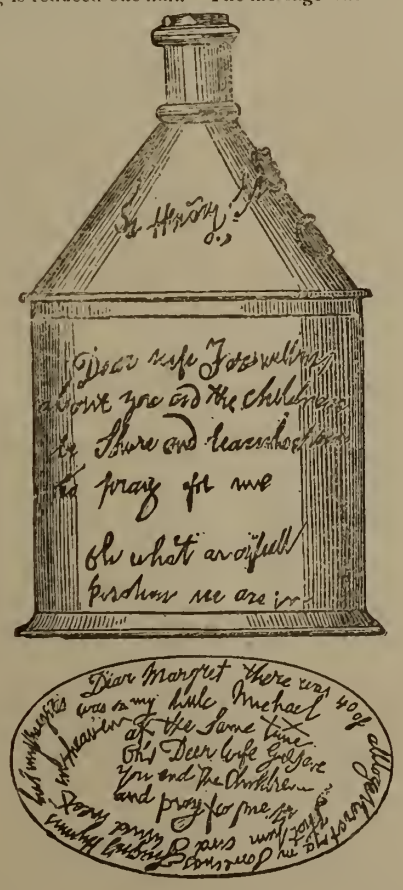
A most interesting illustration of the value of this system, side by side with the channeler, is shown in the northern Ohio sandstone quarries. A great many channeling machines are in use there working around the new form of holes, and when used together in an intelligent and careful manner the stone is quarried more cheaply than by any other process that has yet been devised.

To a limited extent the system has been used in slate. The difficulty is that most of the slate quarries are in solid ledges, where no free faces or beds exist; but it has been used with success in a slate quarry at Cherryville. Pa., since 1888. Among notable blasts made by this system are the following: At the mica schist quarries, at Conshohocken, Pa., a hole 1½ in. in diameter was drilled in a block which was 27 ft. long, 15 ft. wide and 6 ft. thick. The blast broke the stone across the "rift" only 8 oz. of black powder being used. At the Portland, Conn., quarries a single blast was fired by electricity, 15 holes being drilled with 2 lbs. of coarse No. C powder in each hole, and a rock was removed 110 ft. long, 20 ft. wide and 11 ft. thick, containing 24,200 cu. ft., or about 2,400 tons, the fracture being perfectly straight. This large mass of stone was moved out about 2 in. without injury to itself or the adjoining rock.

Another blast at Portland removed 3,300 tons a distance of 4 ins. Seventeen holes were drilled, using 2 lbs. of powder in each hole, the size of the block being 150 × 20 × 11ft. In a Lisbon, O., quarry a block of sandstone 200 ft. long, 28 ft. wide and 15 ft. thick, was moved about ½ in. by a blast. This block was also afterward cut up by this system into blocks 6 ft. square. A sandstone boulder 70 ft. long, average width 50 ft. average thickness 13 ft., was imbedded in the ground to a depth of about 7 ft. A single hole 8 ft. deep was charged with 20 oz. of powder, and the rock was split in a straight line from end to end and entirely to the bottom. A ledge of sandstone open on its face and two ends, 10 × 13 × 8 ft., was moved by a blast about 3 in. without wasting a particle of rock, 8 holes being used, drilled by three men in just one day, and 15 oz. of powder being used in each hole. A sandstone ledge, open on the face and end only, 200 × 28 × 15 ft., containing 84,000 cu. ft. of stone, was moved ½ in. by 25 holes each containing 1 lb. of powder.

A Miner's Last Letter to His Wife.

Inspectors W. N. and J. B. Atkinson, in their account of the disastrous explosion at the Seaham Colliery, record the finding of a tin flask on which was scratched with the point of a rusty brattice an affecting farewell letter by one of the miners, Michael Smith, to his wife. The drawing is reduced one half. The message was:—



"DEAR WIFE—Farewell. My last thoughts are about you and the children. Be sure and have them pray for me. Oh! what an awful position we are in. Dear Margaret, there was forty of us altogether. Some was singing hymns, but my thoughts was on my little Michael, that him and I should meet in heaven at the same time. Oh! dear wife, God save you and the children, and pray for me.

A 1200-Ton Testing Machine.—An hydraulic 1200-ton testing machine has been erected at the works of the Phœnix Iron Co., Pennsylvania. The total length of the machine is 78 feet, and it will take an eye-bar 50 feet in length. It is a modification of the Kellogg machine, and is described in the *Iron Age*.

New Ore Dressing Floor at Freiburg, Germany.

The *Industries* has described in a recent issue a new central dressing floor at the Himmelfahrt mine, Freiberg, Saxony, which has been erected to replace five old floors. The installation was designed by Mr. C. Luhring, whose name is well known in connection with coal washing and ore dressing.

The ores treated in the new dressing floor are, says *Industries*, obtained from the various shafts of the Himmelfahrt mine. They consist, as is well known, of argentiferous lead ores, zinc, blende, silver ores and pyrites, whilst the gangue consists of gneiss. On account of the variety of ores, the dressing floor from the stone breaker to the last settling tank has been constructed in duplicate. It is thus possible to dress ores from other mines without mixing them with the Himmelfahrt ores. This division of the floor into two equal systems is a distinct novelty in ore dressing. The annual production of the Himmelfahrt mine is about 45,000 tons of undressed ore, of which about four-fifths consist of lead ores and the remaining fifth of silver ores. The floor has therefore been designed to dress 150 tons per day of ten hours. The water required is collected in a reservoir with a capacity of 350,000 cubic feet, the average consumption of water being 35 cubic feet per minute. The whole of the machinery is driven by steam power.

At the shaft the best ore and the absolutely worthless gangue are picked out by hand, and the remainder is taken in trams pulled by horses to the dressing floor. The ores contain galena with 0·15 to 0·20 per cent. of silver, iron pyrites, copper pyrites, and, more rarely, zinc blende and gneiss, or quartzose and spathic gangue. Iron pyrites and galena predominate. The zinc blende is black, and contains some 33 per cent. of iron. Its specific gravity, consequently, is nearly the same as that of iron pyrites. On the whole, the ore, as is seen from the foregoing composition, is an exceedingly difficult one to dress.

The dressing floor is arranged in terraces, so as to render the work as continuous as possible. The first building of the washing floor, consists of four floors twelve feet apart and covers an area of 19,300 square feet, or three-quarters of that of the entire works. The topmost floor, to which the ore is raised by a steam elevator is 36 feet above the lowest floor, on which are situated the stamps, and 48 feet above the floor of the central building containing the jigging machines, and that of the end building in which the slimes are treated. These three sections are, as has been already remarked, divided into two similar series, in order to treat ores containing different proportions of silver ore coming from other mines and requiring separate accounts. Each series of apparatus is able to dress 75 tons a day.

The trucks from the mine, containing 22 cwts., after having been raised by the elevator, are tipped into one or other of four large 6-ton hoppers of four stone breakers. The stone breakers are fed automatically, the fine material under 30mm. passing through a screen to a hopper below, and the coarser material passes through the stone breaker to the same hopper. Each pair of stone breakers has one of these hoppers as well as a trommel common to the two. The trommel is provided with screens with apertures 16mm., 12mm., 9mm., and 7mm. in diameter. Lumps from 16mm. to 30mm. pass from the trommel to a hand-picking table, which carries the ore for further comminution down to the coarse rolls on the third floor, whilst the pure ore and worthless gangue is picked out by hand. Material of smaller sizes passes direct to the jigging machines.

The material crushed by the coarse rollers is separated into three sizes: 7mm., 9mm., 5½mm. to 7mm., 4mm. to 5½mm. The first of these is treated in jigging machines, below the trommel The material above 9mm. falls into the trommel upon the medium rolls whose trommel has apertures of 7½mm. and 4mm. The products are treated in jigging machines. The material above 7mm. passing through the trommel is further crushed in fine rolls and then passes to the trommel on the lowest floor where it is separated into material above and below 4mm. The smaller material passes to the trommels of the fine jigging machines, whilst the grains above 4mm. are taken by an elevator to the stamps. Thus there is a continuous comminution from the coarsest to the finest to 30mm. in stone breakers, to 9mm. in coarse rolls, to 7mm. in medium rolls, to 4mm. in fine rolls and to 2mm. in stamps.

The two trommels with which the washing floor for fine material begins, have apertures of 3mm. and 2mm. and the products pass to jigs, whilst the material that does not pass through the screens proceeds to sand classifiers, where it is separated into three sizes—1½mm. to 2mm., 1mm. to 1½mm., and ½mm. to 1mm., which pass to three fine jigs. The material flowing over from the classifier is collected in a reservoir, whence it is pumped up through pipes to the pointed box concentrator, where a further concentration of the fine particles it contains takes place. In this way six classes of sand are obtained. The three first, under ½mm., flow from three pointed boxes to a Bilherz jig. The three classes of finest slimes deposited in the following pointed boxes, proceed to a jigging machine, whence the concentrated product passes to six Stein vanners, where a marketable product is obtained. The waste water passes to three large reservoirs, where it is clarified.

The machinery is driven by a compound steam engine, which indicates 105 horse power. Throughout the works forty-four workmen are engaged, with three overseers, one engine driver, one stoker, and five fitters. The cost of dressing one ton of ore amounts to $2.50.

Meeting of the Asbestos Club.

The monthly meeting of this club, held in the Club House, Black Lake, Que., on 28th ulto. was well attended, Capt. M. Penhale, presiding. After the minutes of last meeting had been read, Mr. L. A. Klein submitted a very satisfactory report of the council principally dealing with the furnishing of the Club House. It was announced that a donation of fifty dollars had been received from the General Mining Association of the Province. A committee was appointed to arrange for the visit and meeting of the General Mining Association to be held in this district on June 9th. Thereafter Dr. Moran read an instructive and interesting paper on the subject of "explosives" which was well received. The next meeting will be held at Thetford on 25th instant.

MINING NOTES.

[From Our Own Correspondents.]

Nova Scotia.

Cariboo District.

Attachments for debts and unpaid wages were made on the Lake Lode property in January. There is no work doing in the district outside of the Dixon property, which is continuing its steady yield.

Darrs Hill.

Rumors were current in November of a new and rich strike at this mine but further developments have shown the lode to be very small, though rich in gold. The crosscut is still being carried South, and the old workings are reported looking as well as usual.

North Brookfield.

Work on the mine continues, and the yield is reported as fully up to the average, which means 14 or 15 dwts.

Molega.

The Boston Gold Mining Co. have been busied during the winter in installing the air drill plant furnished by the Canadian Rand Drill Co. of Sherbrooke, Que. It is reported satisfactory. During Christmas holidays the mill of this company was under slight repairs and during this period the plates are reported to have been roughly scraped, and from $500 to $750 worth of amalgam removed. The thief is unknown. During the same period the property of the Parker-Douglas Co. was entered and some supplies stolen.

Montague.

For the last three months and more the local papers have been announcing the sale of properties in this district to a London syndicate. The facts of the case seem to be that in October, Mr. Lucius J. Boyd of Dublin, made an examination of the whole Montague District on behalf of himself and his partner D. L. Ross of Montreal, and was favorably impressed. Mr. Alfred Woodhouse who was at that time present in the country as consulting engineer to the Nova Scotia Syndicate, at Waverley, likewise visited Montague and was impressed with the value of what he saw there. A combination between the three gentlemen was formed and Messrs. Woodhouse and Ross went to London at once. Shortly after their arrival there they cabled for an option on a *combination* of the Windsor Junction Mine at Waverley owned or controlled by Mr. Annand. By payment of £2500 stg. cash forfeit the option was secured. This option expired in January, but one or two extensions have been asked for and given. At date of writing (17th) the last option expires and as yet no further payment has been made. The Montague properties are well and favorably known; the Waverley property has not been so favorably known.

Whiteburn.

The Graves Mine, operated by Smart, Partington and Reid closed down in January. Several attempts have now been made to operate this mine which have all been unsuccessful. It seems to have been thoroughly demonstrated that the quartz is too poor to pay expenses.

Waverley.

The month of January witnessed the total collapse of "The Sophie Mining Co." which had taken a lease of the T. J. Wallace property at the western end of the district. This company had been in operation just twelve months. The surface plant and machinery has been sold and disposed of.

The Windsor Junction Mine, Capt. MacDuff, Manager, is entirely closed down awaiting developments in London.

The West Waverley Co. are operating every part of their plant but the mill. This should have been ready the first of February, but it will now be the middle of March or later.

The Lake View, on February 1st, announced another departure viz:—that the whole of the mine was to let on tribute, Mr. Hayward having abandoned his lease.

It is rumoured that active operations will be resumed at the tunnel in East Waverley next month. Pipes and rails have been ordered and work will soon be started.

Mount Uniacke.

The Alpha Company have reached the limit of their line boundary and have stopped work. The mill is now stamping the quartz obtained last month.

Messrs. Madill & Co. are at work and Prince & Co. will resume in the spring.

Oldham.

The Rhode Island Company has commenced vigorous operations on the Western Dunbrack lode. They have two men, a boy and a horse at work one shift.

The Concord Mining and Crushing Company appear to have wound up business leaving about $1500 of liabilities and no assets. Nothing has been seen or heard of the guiding spirit of this company for two months.

Quebec.

Hull Township.

The Thompson-Houston Electric Co. is taking out mica on Mr. Chubbuck's lot, 13 in 15th Range, and also on the McLellan lot. The owners of the Gow mine have had a small force of men mining mica during the winter, and recently sold 40 tons of this mineral in the rough state, to the Thomson-Houston Co. A new discovery of phosphate was made on this lot last fall, and is to be exploited this spring. The opening of the Gatineau Valley Railway, which took place a week ago, will greatly benefit mining in this district.

Eastern Townships.

Mr. W. H. Jeffrey is taking out between four and half and five tons daily of asbestos at his Danville mine. This is the only asbestos property at work in this section of Quebec.

The Anglo-Canadian Asbestos Co. will resume mining about the 15th of next month.

The end of March will see a resumption of mining at all the asbestos mines at Black Lake and Thetford.

Templeton Notes.

The Netherlands Phosphate Co. closed down on Friday of last week. Dr. Killing expects to sail for Germany early next month. Until he consults with his directors it will not be known when they expect to resume operations. Over 40 men are thrown out of employment.

The Blackburn Mine is turning out about 75 tons lump phosphate weekly. Hundred and ten men are still employed.

The Templeton Asbestos Co. have struck some good shows of first class asbestos this month. They are grinding their dump stuff at Buckingham which is turning out very well. Mr. Cirkel is well pleased with the past few months operations. About 45 men are employed.

The Electric Mining Co. are working 22 men at the Bull Dog Mine. The average output is about 150 tons this winter.

Messrs. McCraken and McTiernan are working phosphate in the 3rd Range of Templeton with ten men. Their output is very satisfactory.

The miners and farmers almost to a man are supporting the Debouchervillle candidate, Mr. Tetreau.

Ontario.

"The Belmont Bessemer Ore Co." have been completing and improving their buildings at the iron mine and are preparing for active work as soon as the railway is completed. Ties are being delivered along the line, rock-cuts made, and they are building the railway bridge over Beaver Creek at the village of Marmora. The railway from Belmont mine will strike "The Central Ontario Railway" about three miles from Marmora, a short distance North of the C.P.R. Junction, and the Company expect to have it running during the month of May next.

GOLD MINING SUPPLIES.

The principal depot in Nova Scotia, carrying the most complete assortment of first-class goods, is

H. H. FULLER & CO.'S

41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,

Halifax, N.S.

The Belmont Gold Mining Co. is working night and day and are now drifting on the vein about 80 feet from the surface. The ore is being treated at the Crawford Mill in Marmora, $1,100 in gold being reported as the result of the first 110 tons, or $10 per ton. With careful management and a large supply of ore, this ought to pay. A selected sample of arsenical pyrites in which there was no visible gold, when assayed, showed $32 of gold per ton.

Late developments at the Snowdon iron mines have shown new deposits of ore, which are remarkably free from phosphorous, These developments are opportune in view of the increasing interest now being taken in the location of a blast furnace either at Toronto or Hamilton; these ores being the nearest high grade Bessemers to these cities. The distance is 110 miles by rail to Toronto and 150 miles to Hamilton.

Petrolia District.

The shipments of crude, refined and crude equivalent from Petrolia, Ont., for the month of January, 1892, and 1891, are given as follows:—

	1891			1892		
	Crude.	Ref'd.	Crude Equiv.	Crude	Ref'd.	Crude Equiv.
Jan..	19,910	20,974	70,749	17,441	24,751	79,318

At present all upon the surface appears fair and propitious. Crude is worth from $1.29 to $1.32, according to quality and gravity, and the country is not over flooded with refined illuminating oil, so that the refining trade will be fairly brisk and steady till the beginning of May any way. After that date we shall have three or four months of restricted demand, and then business may be expected to resume activity for the fall and winter months of 1892-93.

The stock of crude is very moderate, but ample for the requirements of the trade, taking into consideration the prospective summer production. If the larger producers take care of the raw material and the market in general is let alone and not influenced by outside considerations, the prospect for values for the raw material may fairly be put at $1.50 per bbl. at the least.

If a new area of production is found by what is termed wild-catting, then we must look for cheaper oil. As we have pointed out our stocks are, and will be, ample for the year's business, and it would be but to imitate the folly of our American cousins to encourage greater developments this year. We hear of great preparations for drilling new wells in the spring or as soon as the weather moderates and drillers can move their rigs around with less expense and facility, not alone in our old territory here, but at Oil Springs and elsewhere. Of course, this kind of business is playing right into the hands of the refiner, and there are so few of them that if a large surplus of the raw material is brought up to the surface this year, then good bye to fair prices for the next two or three years to come.

Sudbury District.

Writing to us under date of 19th inst., Mr. H. P. McIntosh, secretary of the Canadian Copper Co., says: Nothing new has transpired in the Ritchie suits, excepting that depositions are being taken therein. The suits against this and the Anglo-American Iron Co's. for their dissolution, instituted by Mr. and Mrs. Ritchie, will come to naught, for they are not owners of one-fifth of the capital stock, as it is necessary for them to be to substantiate such suits. About the middle of last month we started our Bessemer works at Sudbury (three furnaces), and they are working very nicely. We expect to push our business very vigorously this year, unless we are hampered by a Canadian export duty, for which some of your journals are howling.

Some bungling at the Printing Bureau will delay the issue of Dr. Robert Bell's report on the Sudbury district for some weeks yet.

Port Arthur District.

In spite of the adverse conditions of the present Mining Act the spring is opening up with a renewed activity among explorers and small mine owners, and there is great promise of extensive and varied development of numerous prospects. Several of these prospects have lately been equipped with machinery, and no doubt some of them will gradually develop into first class mines.

It is stated on good authority that the Palisades mine, in charge of Superintendent Middaugh, and originally operated by Prof. Winchell of the U.S. Geological Survey, has changed hands in New York at very handsome figures. The company recently had a thorough survey made of their attractive embryo mine including underground works. The samples from this mine rival the finest specimens obtained at any of the famous mines of the district.

The splendid showing at the Lily of the Valley workings in Paipounge Township has created a great influx of explorers with the result that several veins have been discovered, and more or less development work is going on at various outcrops, most of them, of course, claiming connection with their wealthy neighbour.

The Badger and Porcupine mine is still shipping rich ore and the much talked of "West End" will erect a mill as soon as the output and ore in sight assure its success as a profitable investment.

The new "Climax" prospect near the Badger mine has been secured by an American company at figures yielding splendid results to the original owners.

Several experts have been up of late examining the iron formation along the Port Arthur, Duluth & Western Railroad. This section, it is claimed, is an extension of the Mesabi iron range which our correspondents inform us is creating a great excitement, bordering on a boom, in the North Eastern part of Minnesota. About forty miles from Port Arthur the Folger Bros. of Kingston and P. L. S. Williams are steadily at work on a vertical formation of magnetic and hematite ore. Some of the specimens from this neighbourhood yield as follows :—

	1st.	2nd.
Metallic iron	60.9	68.1
Phosphorus	.05	.01
Sulphur	.16	.5
Silica	13.5	4.0
Titanium	none.	none.

The Geological Survey informs us that none of the ores from that region contain titanium. The quality, it will be perceived, is A1, and development alone can determine the quantity. This is the same range in which Professors Pumpelly and Van Dise of the U.S. Geological Survey have invested so heavily.

When the Atikokan Belgian deal is consummated by the building of the branch line and the opening of the mines, as agreed upon, these ores will be valuable to mix with them. Several prospectors are at work on the various iron ranges, chiefly on behalf of United States capitalists.

The silver lead ores of Black Bay are exciting renewed interest at present, development being pushed at the Ogema mine and on one of the irrepressible Duncan McEachen's locations. At both places the results reported are certainly highly satisfactory, the proportion of silver and gold being away over the average,

The Ontario Government have been trying to make amends for their narrow mining policy by making Township and other Surveys in the mining region and building roads wherever operations appeared to indicate successful results.

We would be pleased to learn that some modifications of the mining laws were made, so that there might be greater use for these roads.

What we want badly is a mining school, towards which all the municipalities adjacent would contribute handsomely, and this matter, we learn, is being pushed by our live practical member, which augurs well for success.

Thousands of dollars are wasted annually hereabouts by ignorant and misdirected effort, to say nothing of occasional frauds, which have done immense injury to the district.

It is rumoured that Port Arthur and Fort William will shortly amalgamate under a new name. The result would be most beneficial both to themselves and the District at large.

British Columbia.

Ainsworth District.

In its review of last year's mining in the Ainsworth District the *Miner* says :—"The year 1891 opened with men doing development work on the Skyline, Number One, United, Neosho, Tenderfoot, Dictator, and several other claims of lesser note, and closed with men on the Skyline, United, Tenderfoot, Krao, and Neosho. The amount of work done, in the aggregate, was more than during the previous year, and was of a character that went to prove that the ore bodies go down. Ore was shipped from the Number One, Neosho, and Tam O'Shanter, the Number One shipments going to East Helena, Montana, and those from the Neosho and Tam O'Shanter to Tacoma. The first transfer of consequence was that of A. D. Wheelet's interests in the Skyline, Krao, Crow Fledgling, Blackbird, Maestro, Banker, Pataha, Attended, Bugaboo, Libby, and two or three side locations to W. L. Hoge of Anaconda, Montana, Mr. Wheeler receiving $5,000 cash on a 1-year bond for $35,000. Later, a number of sales were made ranging from a few hundred dollars for prospects to several thousand dollars for claims like the Tam O'Shanter, Tenderfoot, and Neosho, the last-named selling for $10,000 cash, Dr. Coe of Seattle being the purchaser. The Tam O'Shanter was sold to a Montreal company, through Richard Irwin, a Colorado mining man, and the work done on it afterwards proved his judgment good. The Tenderfoot brough $7,500, Richard Ashworth and Wilfred Jevons, Montana and Wyoming cattle men, being the purchasers. Since purchasing the property they have expended several thousand dollars in erecting a shaft-house, and putting in hoisting-works, and now have 12 men at work sinking a 2-compartment shaft. While the ore shipped was not as high-grade as that shipped from the Skyline last year, the total amount obtained from its sale was about the same as that realized last year. In fact, owing to the specific wording of the McKinley bill, no ore could be shipped to the United States at a profit unless it was high-grade in silver and low in lead ; and, as is well known to mining men, the great bulk of the ores of the division are high in percentage of lead and low-grade in silver. So to the McKinley bill can be attributed the small tonnage shipped during the year, and to the same measure is ascribed the cause why more work was not done, for owners of claims saw the uselessnes of extracting ore merely to let it remain piled on dumps. No new strikes of consequence were made in the section of the division adjacent to Ainsworth, but the prospectors who make Ainsworth their headquarters are entitled to all the glory for making the new finds on Kaslo creek and for creating the stampede to the Slocan Lake country.

On the Skyline, the 2-compartment shaft commenced in the fall of 1890 was sunk 200 feet in all. At 190 feet a station was put in and a cross-cutt run 150 feet to the ledge, which, when tapped, was found to be 12 feet wide. An upraise was then made to the old incline shaft, the connection being made in December. Ten men are now at work. Work was not commenced on the Krao until late in the fall, and when the hoisting machinery was started it was found that the shaft would have to be straightened and retimbered before sinking could be resumed. The repairs were made and the work of sinking has commenced. When down 200 feet a station will be put in and drifts run both ways on the ledge. As no cross-cutting has been done, the width of the ledge is not known, but at the bottom of the shaft it is said to be fully 12 feet—all good concentrating ore. The working force is 12 men. Aside from about 200 feet of drifts run in extracting ore, little or no development work has been done on the Number One. Work was entirely suspended in November. The United shaft was sunk 110 feet and drifts run 50 feet both ways on the ledge from the 100-foot station. Work was suspended early in the spring, owing to some difficulty with the machinery, and was only resumed in December. On resuming it was found that the 2-compartment shaft would have to be timbered all the way down, and until that work is completed only 6 men will be employed. On the Tenderfoot a working shaft was sunk on the ledge 100 feet, and 12 men found employment in continuing that work. Since purchasing the Neosho, in September, the new owners of that claim have sunk the shaft 60 feet and run several drifts. The shaft is now down 100 feet and the ore body is reported 7 feet wide. Six men are employed. Early in the spring work was resumed on the Fourth, and until suspended late in the fall, over 300 feet of tunnels, drifts, and crosscuts were run, must of the time in ore. The ore extracted is on the dump, and will remain there until a waggon road is built to the mine, it being distant about 2 miles southwest from the United. Among the prospects on which work in excess of the annual assessment was done were the Dictator, 200 feet of shafts and tunnels ; Crescent, 50-foot shaft ; Libby, 100-foot shaft ; Norman, 50-foot shaft (still working) ; Lady of the Lake, 50-foot tunnel ; Glengarry, 50-foot shaft ; Blackbird, 50-foot shaft (still working) ; Snowbank, 75-foot shaft ; Ellen, 45-foot tunnel ; Ajax, 40-foot tunnel ; On Deck, 75-foot shaft ; Dellie, 70-foot shaft and open cuts exposing ledge for a distance of 300 feet ; Early Bird, 60-foot tunnel ; Minneapolis, 150 feet of tunnels. The annual assessment work was done on 150 other claims.

On the east side of the lake, little or no work was done on the Blue Bell, that property being in good shape for ore extraction. On the Kootenay Chief a shaft was sunk 100 feet by contract. On the Tam O'Shanter a 70-foot tunnel was run on the ledge, proving the ore body to be about 8 feet wide. On the Josephine, a claim purchased late in the season by Butte parties, development work is now being done. At Crawford's bay R. H. Kemp and associates did considerable work on a group of claims that are reported as showing good indications.

Nelson District.

The work done during the year on the Silver King proved that the ore body is not only continuous but that it goes down. The main tunnel is now through the Silver King ground and 25 feet into the Kootenay Bonanza, it being in 750 feet in all, with the face fully 300 feet below the surface. A winze was sunk in the tunnel to a depth of 64 feet, and a 100-foot crosscut run from its bottom. Five crosscuts were run from the main tunnel, the last showing the ore body to be 35 feet in width. In all, about 1000 feet of tunneling, and crosscutting was done during the year, and including the money expended on the waggon road fully $50,000 were disbursed for wages, supplies, etc. Twelve men are now employed in the tunnel.

On the Dandy, over 500 feet of tunnels, drifts, and crosscuts were run, at an expense of $15,000.

On the Grizzly Bear, abont 300 hundred feet of tunnels, and crosscuts were run, at a cost of $9000, and 8 men are still employed. An aggregate of 1000 feet more of tunnels and shafts were run and sunk on the Whitewater, Wild Cat, Vinita Boy, Royal Canadian, Lizzie C., Hidden Treasure, Democrat, Sunrise, Muldoon, Majestic, Evening, and other claims in the division. The amount of money expended during the year can safely be placed at $100,000 for development work, most of the assessment work being done by claim owners themselves. For that expenditure there is fully $100,000 worth of ore on dumps, where it will probably remain until reduction works are erected in the district.

About 50 sales of claims, of more or less value, were made during the year. Early in the Spring E. M. Esler purchased an eighth interest in the Dandy for $4,000 cash and obtained a bond on the other seven-eighths at a figure up in the thousands. Owing to the delay in beginning work on the waggon road from Nelson to Toad Mountain, which rendered it impracticable to place machinery on the property, the terms of the bond were readjusted late in the fall and most of the working force laid off. The Iroquois was purchased by J. E. Boss for $14,000 cash. Mr. Boss also purchased the Grizzly bear and Silver Queen, paying $8,000 for them. Other sales were made at figures ranging from $250 to $2,500, the latter price being paid for the Last Chance and the Jim Crow, and for an interest in the Ollie. J. C. Cobaugh transferred his interest in the Hall mines for $20,000 cash, the interest being a twenty-sixth. John Wallace's interest in the Whitewater on Rover creek was also sold during the year, at a figure said to be $10,000. The sales for the year aggregated fully $100,000.

Nanaimo.

The foreign shipments of coal for January are reported as follows : N.V.C. Co., 17,525 ; Wellington, 15,567 ; East Wellington, 2,270 ; Union, 8,700.

Connection has been made between Protection Island and the Esplanade Shaft of the New Vancouver Coal Co. The distance in a straight line between the Esplanade and the Protection Island shafts is not much over one mile, but the level (and the counter or air level, which runs parallel with it all the way) which had to take a circuitous course, covers a distance of over two miles. For the first mile barren ground was mostly encountered. Where the coal should have been, a mixture of coal, shale, and dirt took its place ; then, for several hundred yards the drifts had to be driven through very hard rock, sandstone and conglomerate ; this being passed a splendid bed of clean bright hard coal was reached. From that point to the distance of over one mile the coal held good, and in all the drifts going forward the uniform quality of the seam is remarkable. The main level of No. 1 shaft, under Protection Island, has been running two shifts, but will in the future be driven three shifts. An incline will be started to the rise of this level without stoppage. As the outcrop workings ot the old Newcastle mine are upwards of two miles distant from the No. 1 level, there is an enormous area of maiden ground to be exhausted, to the line of the level alone. Taking into account the ground lying between the No. 3 and No. 1 levels, which appears to be in same zone as No. 1 coal, the body of coal actually proved is simply enormous. Until the electric tramway is in operation and its capacity tested, nothing will be done to the wharves on Protection Island, nor is it yet decided whether to divide the output between the Esplanade and Protection shafts, or to confine it to one shaft alone. A new shaft will have to be sunk on Protection Island before long ; it is simply a question as to the selection of the best site.

Mr. S. M. Robins, Manager of the New Vancouver Coal Co., who has been recuperating his health in the South, has returned to the mines. On being interviewed by a local paper he said :—

"After having made careful enquiries from every source possible, I have found in each instance that all authorities, not only in San Francisco, but evcrywhere down the coast, have no hesitation in declaring that Vancouver Island coal is far better in quality than any other on the Pacific. The three best mines south of the boundary are acknowledged to be the Franklin, Black Diamond and Granville, and the coal turned out even from these can in no respect compare with ours. From hundreds of mines on the other side comes the most rubbishy poor stuff that one can imagine. I have seen them continually washing their coal to get the dust, which forms the greater portion of the bulk, out of it. After this operation, there is not a lump of any size left in it. The engineers of the Southern Pacific system hate the sight of it, but they are compelled to use it on account of its cheapness. Speaking with a prominent official of this road, the other day, he told me that they had to consider economy in fuel above all things. He assured me that during the year past the Union Pacific Company had burned $4,000,000 worth of coal less than had his company in the same time. At present, there is a good deal of difficulty in getting our coal on the Sound, as there is a duty of 75 cents per ton. But I think we will be able, before long, to work some in with the aid of a barge system of transportation. I tell you, that if that duty of 75 cents on the ton was taken off we would close up every coal mine on Puget Sound in the next two years. We have had enough of getting time charters on steamers and vessels, so in March next you will see a fine collier, the forerunner of a fleet, come out here from Liverpool to engage in our San Francisco trade. We are, at present, building very extensive coal bunkers and a bridge on a new solid wharf, lately constructed by the Harbor Commission there. We will, of course, continue to run sailing vessels, for if we had nothing but steamers engaged in the trade we could gain nothing. There are only four places in San Francisco where they have facilities for discharging 1000 tons of coal a day, and the time steamers must have to wait would eat up all their profits. Nobody, of course, can tell the turn things will take, but it seems clear that our Island coal can always command its own market in the South, among the many other varieties, all of very inferior quality."

The total output of the Wellington colliery for the year is reported to have been 328,627 tons ; and of the Union colliery, Comox, 130,917 tons.

Foreign shipments of coal were, for the year, divided as follows :—New Vancouver Coal Co., 377,561 tons ; Wellington, 229,271 tons ; East Wellington, 36,085 tons ; Union colliery, 94,990 tons.

The output and shipments for the New Vancouver Coal Company, for the year 1891 were as follows :

	OUT-PUT 1891.		SHIPMENTS.	
	tons.	cwt.	tons.	cwt.
Southfield	201,027	17	198,965	3
No. 3. Shaft	61,235	8	62,310	16
No. 1. Shaft	158,320	19	157,494	9
Northfield	108,006	10	104,528	15
Total	528,590	14	523,299	3

The new shaft in course of sinking at Harewood is down 150 feet. The work is progressing through very hard conglomerate, and is about half completed. The mine is about three quarters of a mile from the old Harewood mine. The first half of the shaft was sunk with steam drills, but the heat became so oppressive for the miners that the company substituted compressed air drills. It is expected coal will be reached in about two months, when a second shaft will possibly be sunk.

McMurdo District.

A petition is on the rounds, and has so far been unanimously signed by the Free Miners of the above district, calling for a grant of $2,500 to be applied during the coming summer in making and repairing trails in their locality. Last summer a liberal grant was obtained, and a lot of work done, but there still remains much to do, and it is hoped, when more have signed, that Col. Baker, to whom the document is addressed, will on receipt do his best to meet the requirements of the miners and prospectors.

Texada Island.

On the land belonging to the San Juan Lime Company on Texada Island there is a large deposit of marble. The marble is of two shades, one white and the other grey, of excellent quality and which when worked and polished, are equal to any of the qualities of marble brought from the East. The quarry has been leased to Messrs. P. Wade & Co., who now have men on the ground doing the preliminary work for opening up the quarry. The specimens of the marble which have been shown to various architects and builders have been generally admired, and there is no doubt that this material will be largely employed in the Province for ornamental work (both internally and externally) on the better class of buildings, whether of a residential or business character.

Miscellaneous,

A recent letter from the manager of the Grizzly Bear mine, owned by the Stadacona Silver-Copper Mining Co., states that "the cross-cut from the heading of the tunnel to the hanging wall, is all quartz and full of mineral, and improves the further it goes into the cross-cut." The weather at the mine was good, though the snow was seven feet deep.

The Westminster Slate Co. have secured carrier pigeons with which to begin message service between the quarries on Jervis Island and the company's head office in Westminster. The birds will be trained and a sufficient number kept at each station to supply requirements. It is expected the system will work satisfactorily.

CANADIAN COMPANIES.

The Newport Plaster, Mining and Manufacturing Company (Limited) give notice that application will be made at the next session of the Legislature of Nova Scotia for the incorporation of this company.

The Vancouver Dynamite and Powder Company (Limited) desires incorporation under the Companies Act of British Columbia to carry on the business of manufacturing, and trading in dynamite, nitro-glycerine, blasting powder, and all other explosives of every description. Head office, Vancouver, B.C. Capital stock, $100,000 in 1,000 shares of one hundred dollars each. Applicants, Johann Wullffsohn, Donald McGillivray and Edward Arthur Morris.

The Kootenay and Columbia Prospecting and Mining Company (Limited).—Application for incorporation will be made under the Companies' Act of the Dominion, to carry on a general mining business, to buy, work and sell mines, quarries, mining lands and minerals of all kinds, in the Dominion of Canada. Head Office, Ottawa. Capital stock, $40,000, in 400 shares of $100 each. The applicants are, George Patrick Brophy, civil engineer ; William Anderson Allan, contractor ; Hector McRae, merchant ; and Edward Watts, miner, all of the city of Ottawa ; and William McNally, merchant, of Montreal, P.Q.

Lanark Consolidated Mining and Smelting Company.—At a meeting of this company held recently, Thos. Earle, M.P., was elected President and Messrs. F. S. Barnard, W. J. Goepel, N. P. Snowdon, and the Rev. Canon Beauland, the Board of Trustees ; G. A. Sargison, 48 Langley Street, Victoria, B.C., Secretary. The company's mines include the Lanark, Red Fox, Isabella and Doherty, in one group, and the Sutton and Sprague a short distance away. Development work at the Lanark is now well under way.

Slough Creek Mining Company.—This company has been incorporated under the laws of the State of Washington to work placer ground on Williams Creek, in the Cariboo district, Province of British Columbia. Capital $500,000. Directors, W. H. Fife, Hon. Henry Drum, Hon. John Grant, J. D. Caughran, E. N. Ouimette, Chas. Ramos. Head Office, Hon. Henry Drum, Secretary, Fife Block, corner 9th Street and Pacific Avenue, Tacoma, Wash.

Duluth and St. Paul Mining Company.—This company has been formed to work the Fourth and other claims near Coffee Creek. The capital stock is $200,000 in $100 shares, and the incorporators are John Graham, Minneapolis ; James McNaught, of New York ; E. C. Long, N. C. Thrall and F. Wilsey, of St. Paul : G. C. Howe and John H. Upman, of Duluth.

The Rosedale Pressed Brick and Terra Cotta Company, (Ltd.)—Give notice that application will be made for incorporation under the Ontario Act, to make and sell bricks and other products of clay and shale. Head office, Toronto. Capital stock, $30,000, in 300 shares of $100 each. The applicants are : W. T. Jennings, C.E.; Humphrey Lloyd Hime, estate agent; Donald Campbell Ridout, engineer; Thomas Parker, brick manufacturer; and James David Edgar, solicitor; all of the city of Toronto.

Cumberland Railway and Coal Company.—The annual general meeting of this company was held during the month at the offices in Montreal. By reason of his illness, Mr. John McDougall, president of the company, was unable to attend, and Mr. Robert Cowans, vice-president, occupied the chair. The annual report and the financial statement were presented. Both were found to be very satisfactory and unanimously adopted.

The Sudbury Customs Smelting Company, (Ltd.)—Give notice that application will be made for incorporation under the Ontario Act, to erect and operate a Customs smelter or smelters at or near Sudbury; to mine and smelt nickel and copper ores, etc. Head office, Sudbury, Ont. Capital stock, $75,000, in 7,500 shares of $10 each. The names and addresses of the applicants are : James Conmee, M.P.P., Port Arthur; James Stobie, prospector, Stobie, Ont.; Rinaldo McConnell, lumberman, Mattawa; Stephen Fournier, merchant, Sudbury; Frank Cochrane, merchant, Sudbury; James McCormack, merchant, Sudbury; Robert Bruce Struthers, M.D., Sudbury; Mathew Wm. James McCormack, merchant, Sudbury; Charles Kettyle, merchant, Sudbury; Daniel O'Connor, hotel keeper, Sudbury; James Flannery, hotel keeper, Sudbury; Alex. Hoffman Smith, manufacturer's agent, Sudbury; Charles Jessop, prospector, Sudbury; Wm. John Skynner, prospector, Sudbury; James Boyle Hammond, chemist, Sudbury; James Andrew Orr, editor, Sudbury; Charles Gordon Richardson, professor Ontario Veterinary College, Toronto; James Robertson Gordon, C.E., Toronto; William McVittie, prospector, Whitefish; Alex. Murray, analytical chemist, Sudbury; Angus James Macdonnell, manager of Ontario Bank, Sudbury.

The Cross Lake Silver Mining Company, (Ltd.)—Give notice that application will be made for incorporation under the Ontario Act, to explore for, buy, sell and work mines and mineral lands in Ontario; to buy, sell, smelt and refine ores of nickel and silver, etc. Head office, Toronto. Capital stock, $50,000, in 500 shares of $100 each. Applicants are : Jeremiah Daniel Cockburn, merchant, Sturgeon Falls; Walter Cockburn, merchant, Sturgeon Falls; Adam James Cockburn, prospector, Toronto; Frederick Reesor James, broker, Toronto; Thomas Urquhart, barrister-at-law, Toronto.

The Drury Nickel Company (Ltd.)—This company has been incorporated under the Ontario Act, on the 6th January 1892, to acquire and work mines and mineral lands and to smelt, refine and treat nickel and other ores. Capital stock $500,000 of which $250,000 is to be first preference stock, divided into 10,000 shares of $50 each. Richard Peter Travers, mining capitalist, Chicago ; Henry Roger Durkee, real estate dealer, Chicago ; Auguste Francke Mason, capitalist, Boston, Mass.; Thomas Lothrop Nelson, capitalist, Boston, Mass.; Henry Richard Valprey, manufacturer, Boston, Mass.; Francis Austin Whitney, manufacturer, Leominster, Mass. ; and Thomas Travers, mining superintendent, Township of Drury, District of Algoma, Ontario.

The Oneida Quarry Company (Ltd.) give notice that application will be made for incorporation under the Ontario Act, to manufacture and sell stone, marble, glass and lime. Head office, Township of Oneida, County Haldimand. Capital stock $50,000 in 500 shares of $100 each. The applicants are :—Charles Sidney Hotchkiss, manufacturer, Brantford ; Cortland De Cew, lumberman, Aylmer, Ont. ; Wm. Edward Winskel, M.D., Brantford ; George Henry Wilkes, banker, Brantford ; Frank Wilson, agent, Brantford ; and Harman Stenebaugh, merchant, Brantford, Ont.

The United Asbestos Company (Ltd.) recommend a dividend for the past year of 10 per cent. on the preference and 5 per cent. on the ordinary shares, carrying a substantial balance forward.

The New Toronto Oil and Natural Gas Company (Ltd.) give notice that application will be made for incorporation under the Ontario Act, to bore and work wells of oil and natural gas and construct pipe lines, etc., for light, heat or power in the county of York, Ont. Head office, Toronto. Capital stock $150,000 in 15,000 shares of $10 each. Applicants are :—Lewis Gibson Harris, broker, Toronto ; Joseph Barrett, broker, Toronto ; Achd. John Thompson, cattle dealer, Toronto ; Thomas McDonald, manufacturer, Toronto ; Wm. Parsons, broker, Toronto ; James Wright, electrical engineer, Montreal ; Lawrence Fawler Faught, oil producer, Pittsburg, Pa., and William Sharp, oil producer, Pittsburg, Pa.

The R. J. Doyle Manufacturing Company of Ontario (Ltd.)—This Company has been incorporated under the Ontario Act, on the 14th January, 1892, to quarry and manufacture stone, lime and clay for making whiting, putty, brick, tile pottery, artificial stone and other cements. Capital stock, $100.000 divided in 2000 shares of $50 each. Richard Judsin Doyle, Sr., Insurance manager, Township Sarawak ; Richard Judsin Doyle, Jr., farmer, Township Sarawak ; Robert Alexander Starke, saw miller, Township Derby ; John Thomson, merchant, Township Sydenham ; Archibald Duncan, hotelkeeper, Owen Sound.

The Lindsay Stone and Lime Company (Ltd.)—The lands of this company, which are as follows :—

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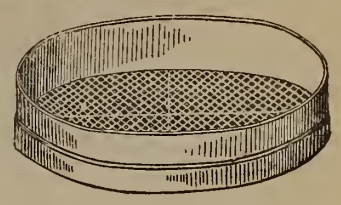

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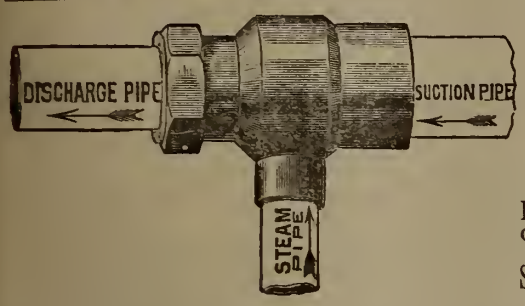

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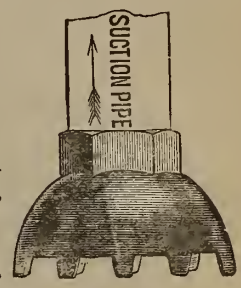

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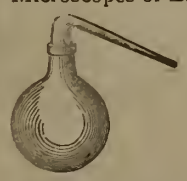

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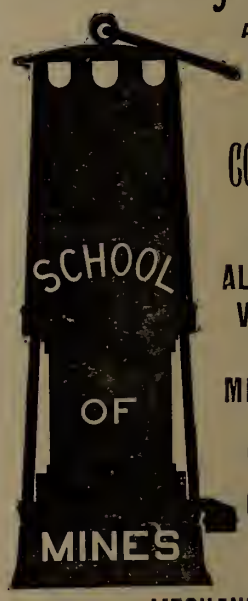

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Applications for Licenses or Leases are receivable at the office of the Commissioner of public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

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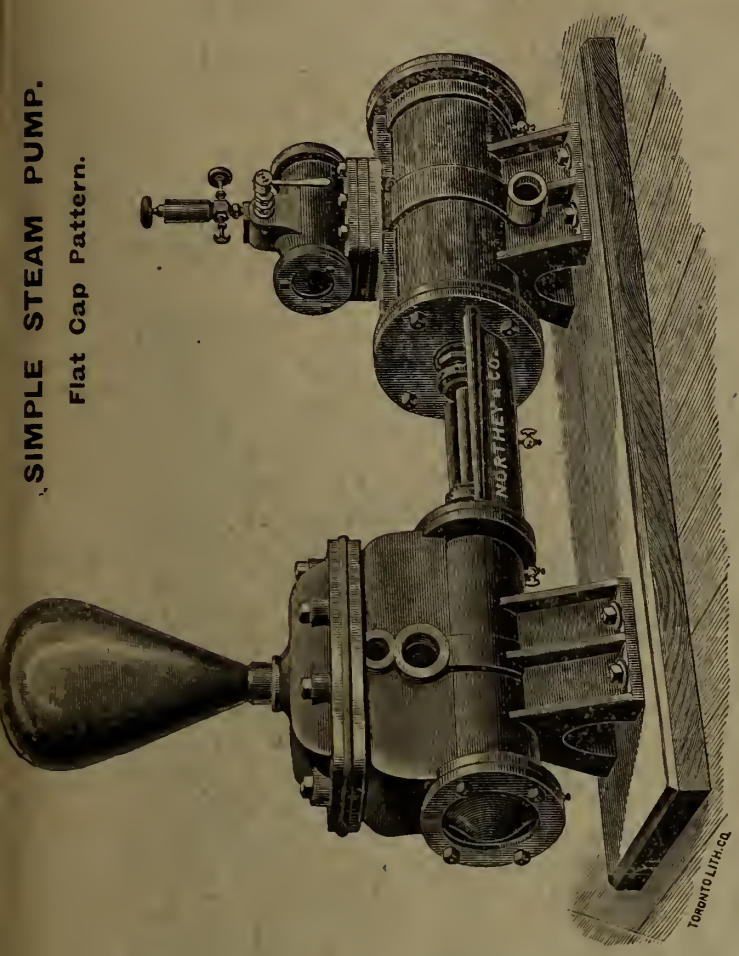

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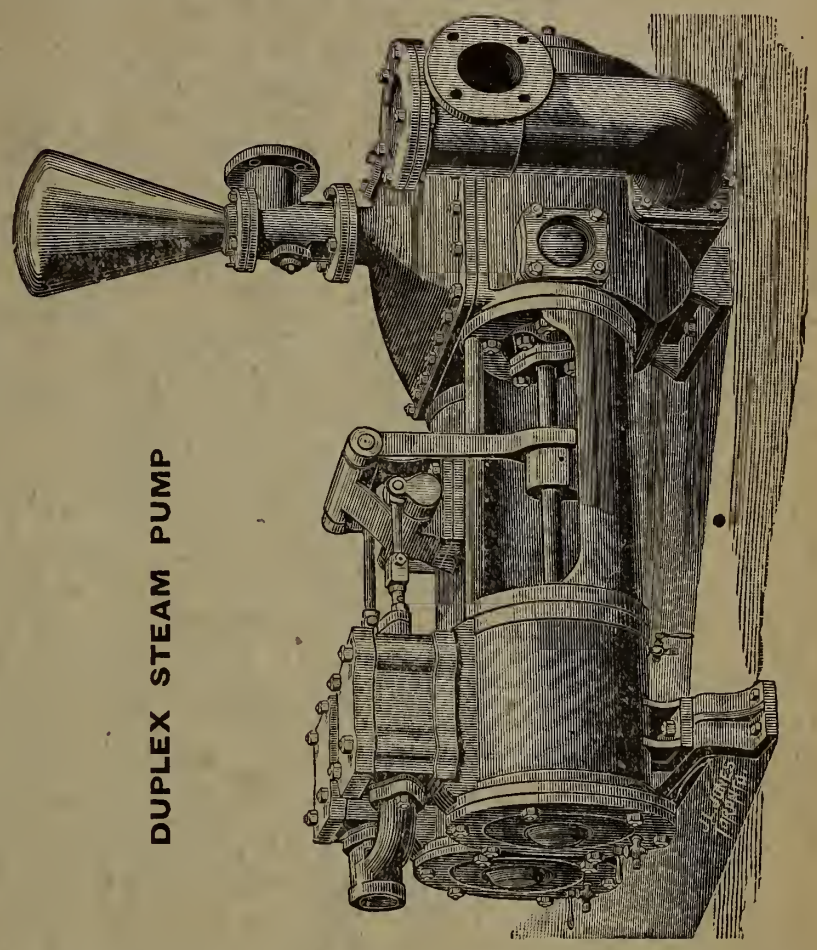

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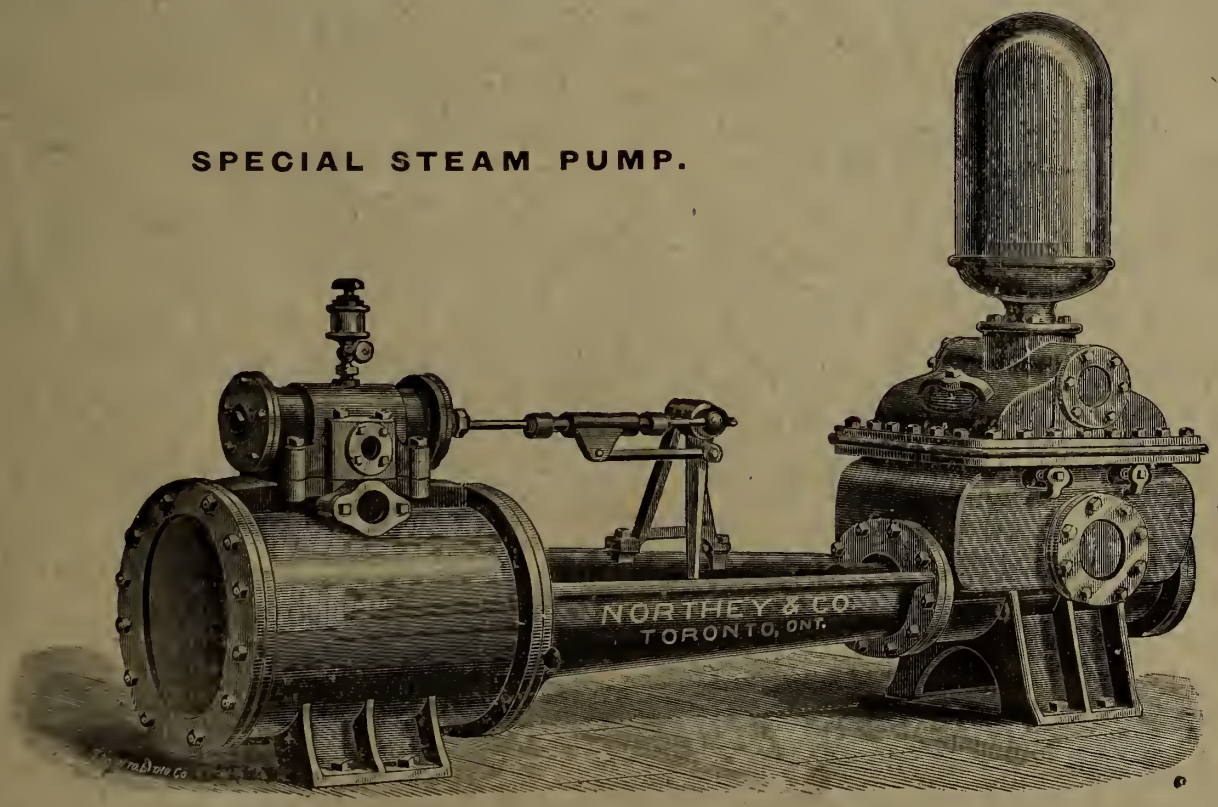

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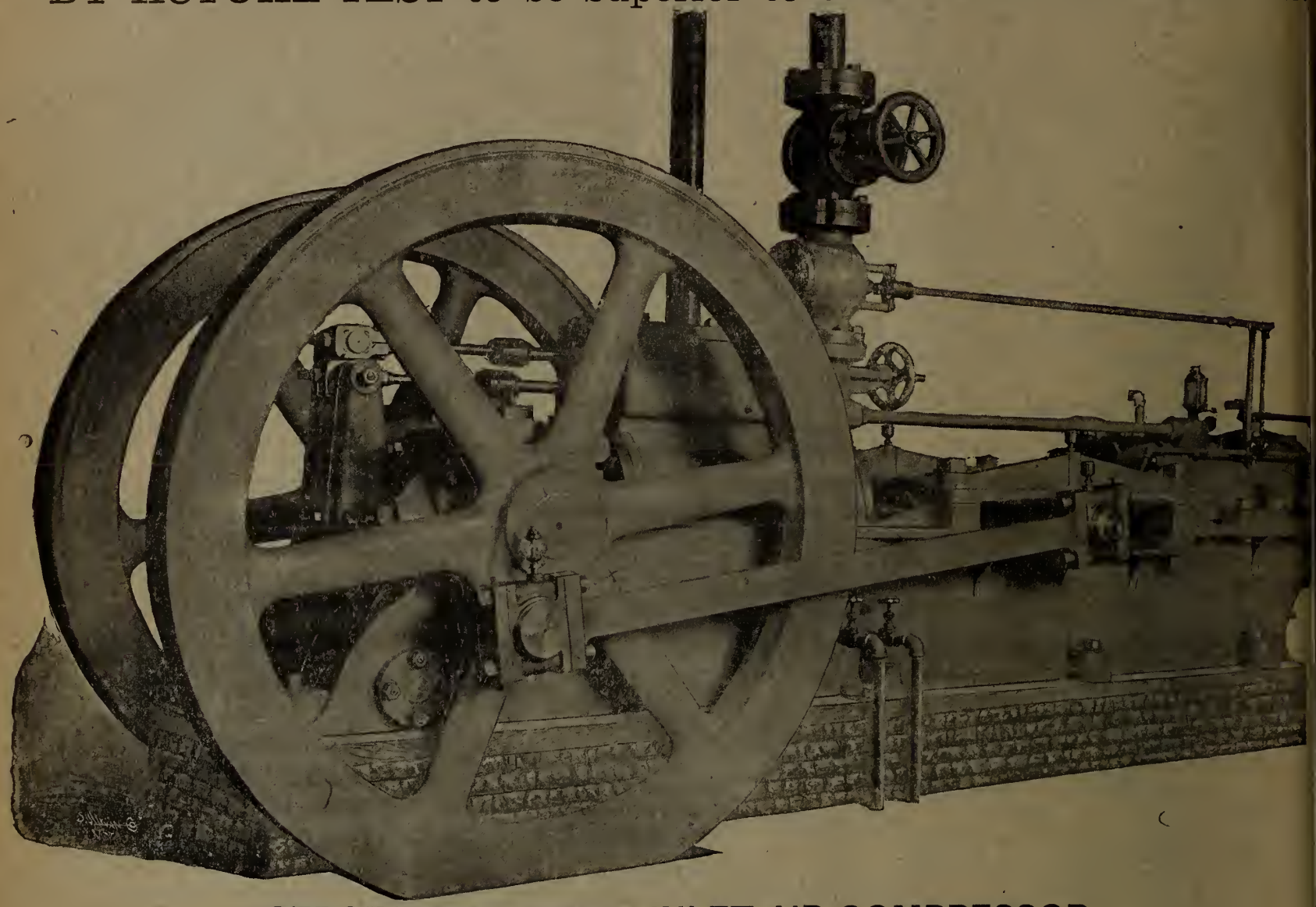

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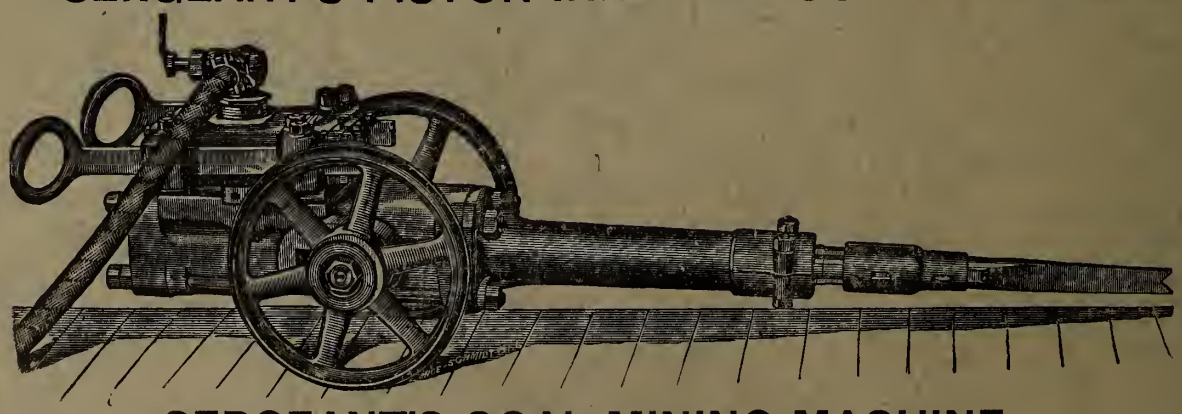

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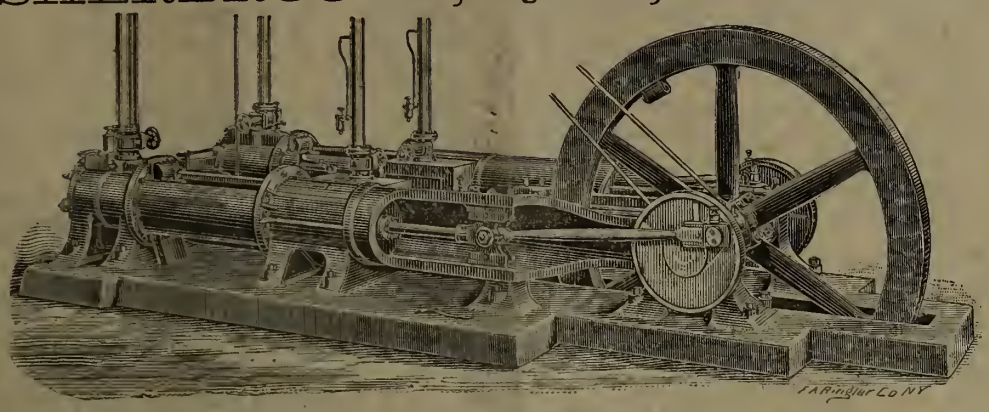

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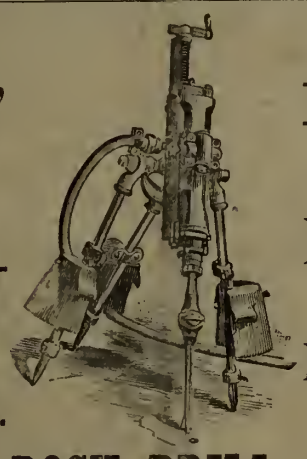

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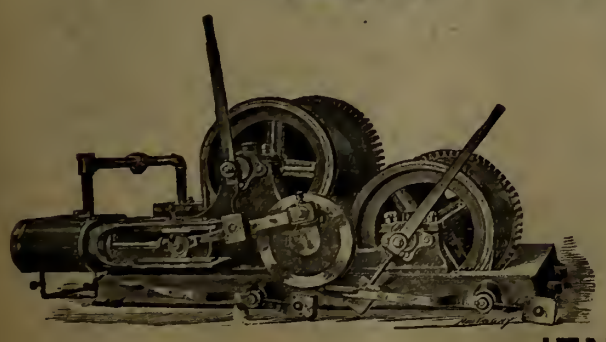

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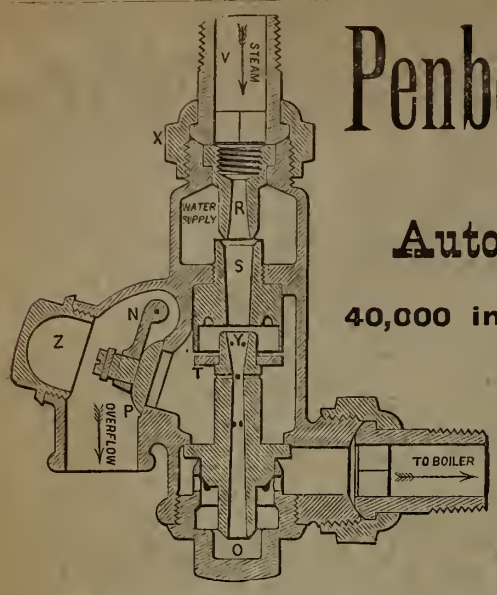

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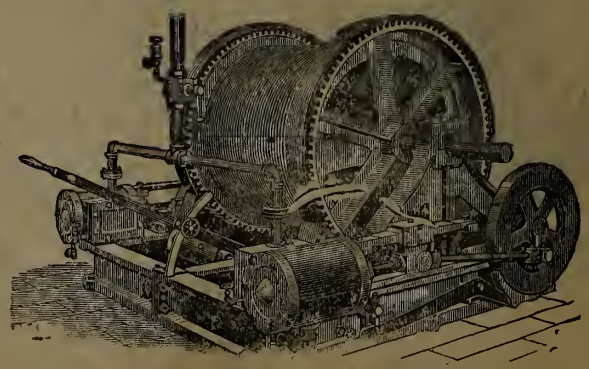

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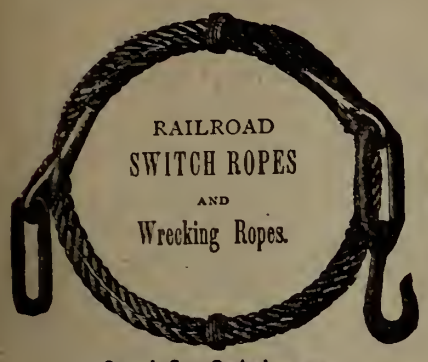

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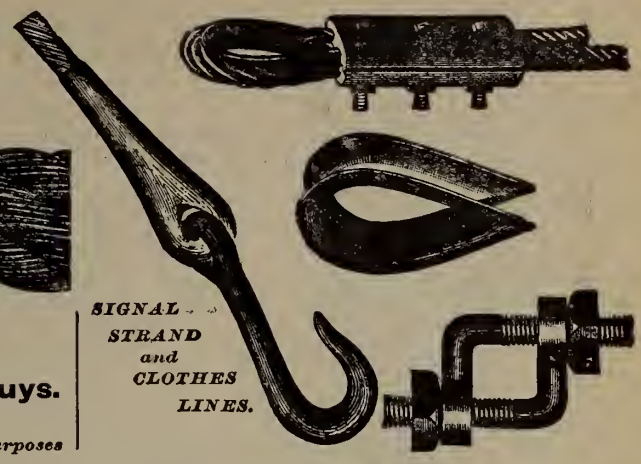

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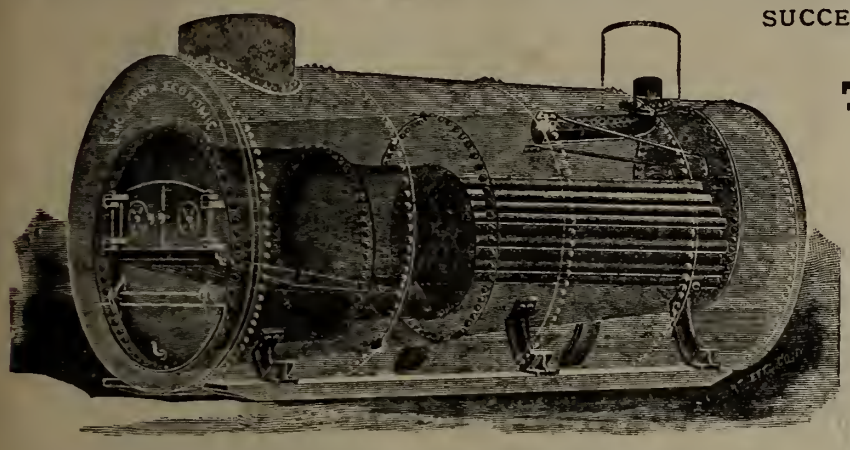

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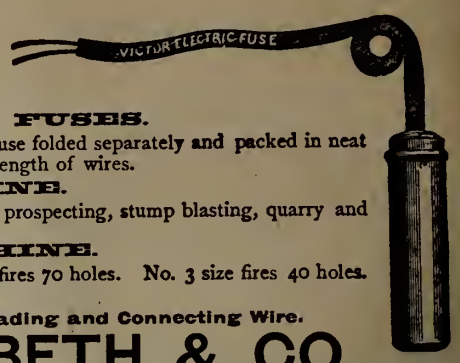

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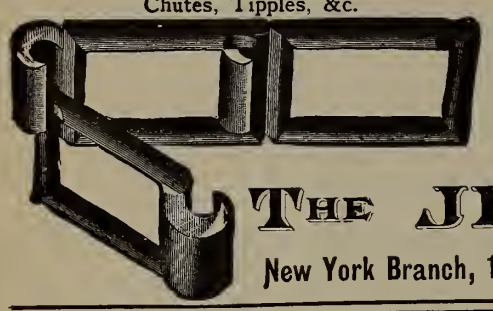

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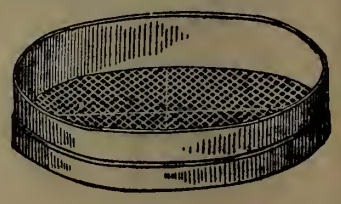

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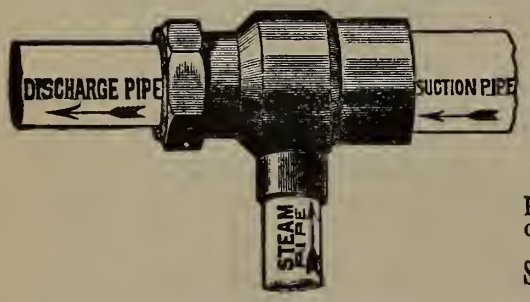

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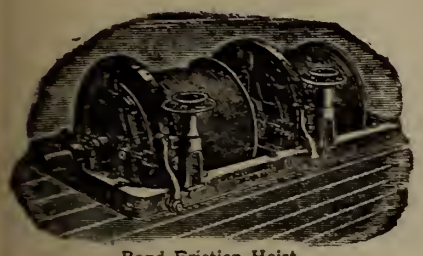

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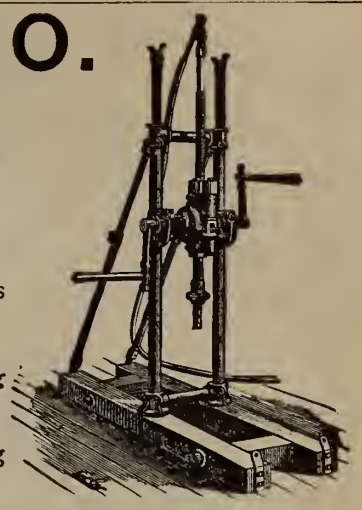

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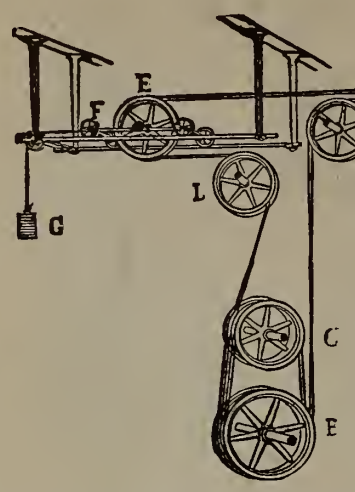

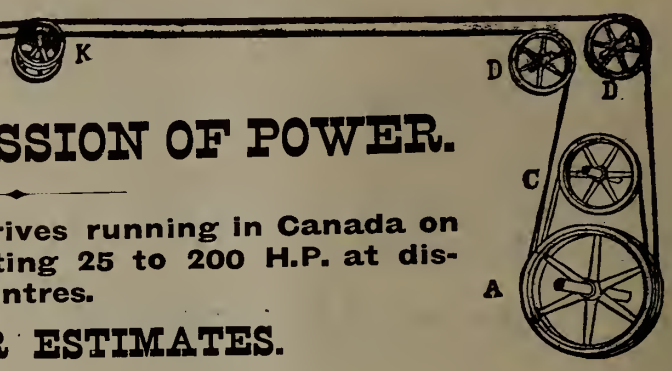

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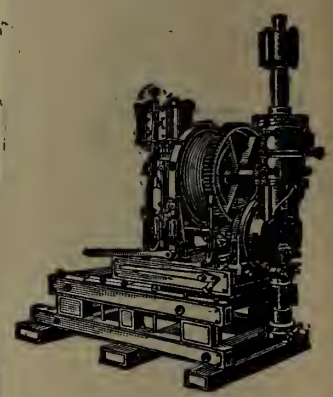

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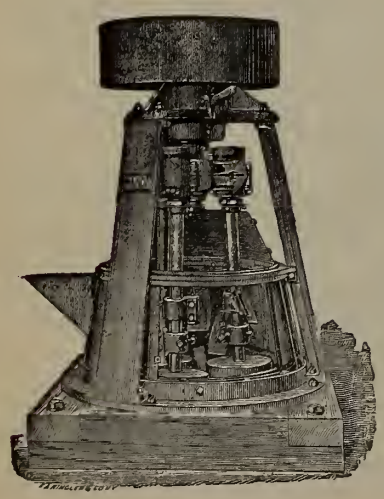
Removes $1\frac{1}{4}$ inches solid core.



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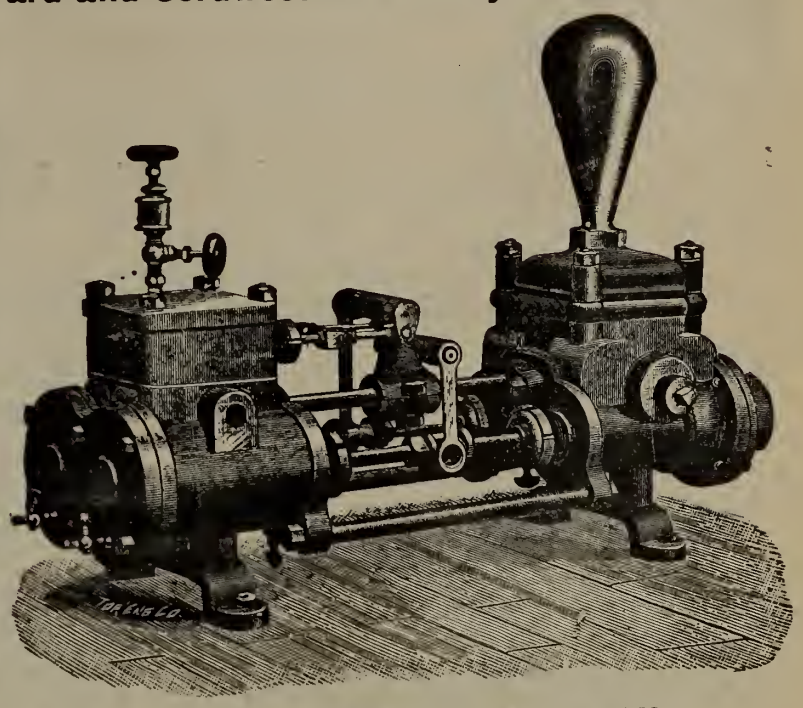

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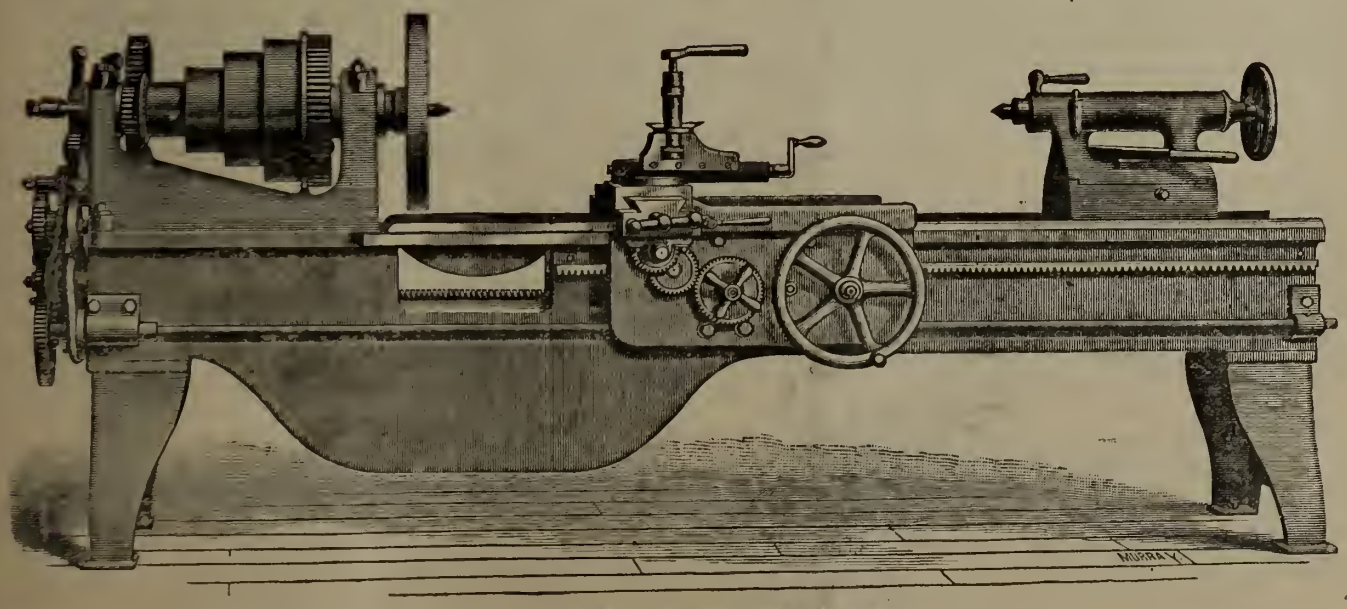

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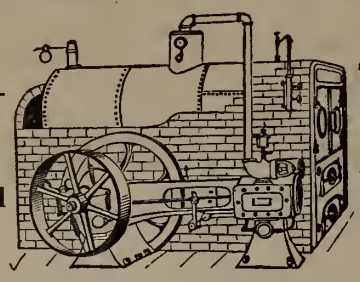

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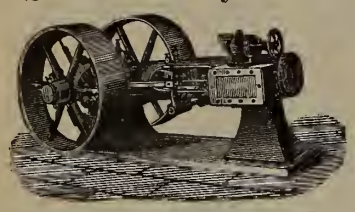

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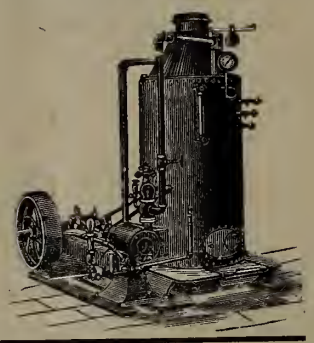

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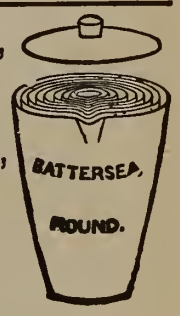

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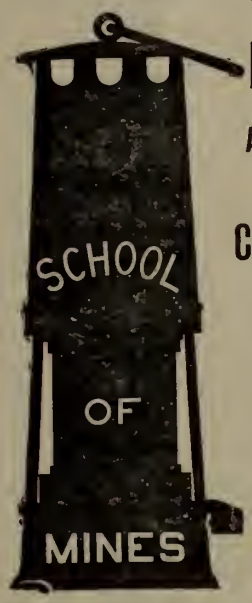

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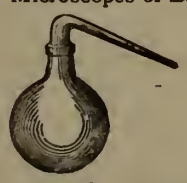

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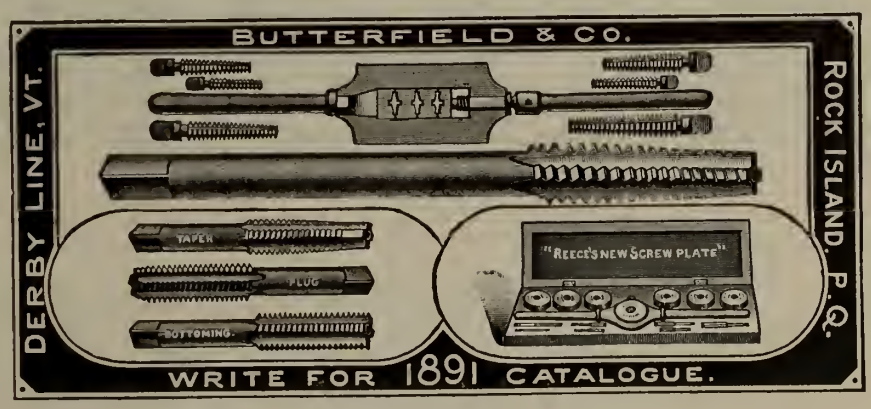

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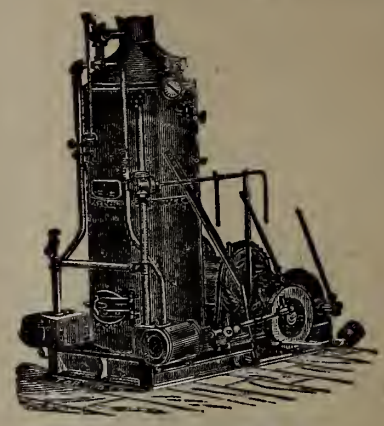

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Vol. XI. MARCH, 1892. No. 3.

The Manufacture of Iron in Nova Scotia.

The returns of the mineral production of Nova Scotia for the year 1891 show a small general increase. This increase can scarcely be considered flattering in any way proportionate to the extent of her resources and their facility of development. The greatest comfort to be derived from the returns is in the evidence of increased interest in the iron ore deposits. Returns show that it was mined at Londonderry, Pugwash, Torbrook, Bridgeville and Springville. The coal companies have also shown lately an increased interest in coke, the co-factor of iron ore. It is now made at the Albion and Drummond collieries in Pictou, at Gowrie, International and Sydney collieries in Cape Breton, and it is reported that Springhill will shortly begin its manufacture. The Londonderry Iron Co. has prepared for an increased production, and draw their ore from their own mines near their furnaces, as well as from Torbrook and Pugwash. They both buy coke, and in their own ovens make it from Springhill and Pictou slack. The public importance of a large iron ore smelting plant may be estimated from the fact that the Intercolonial Railway delivered at Londonderry station last year 56,000 tons of coal and about 22,000 tons of coke.

The enterprise of a few local capitalists has resulted in a systematic and promising attempt to develop the iron ores of Pictou county, which present enormous deposits of this mineral in every variety sought by the smelter. At the point where the East River of Pictou branches, about three miles south of the Pictou coal field —and the Intercolonial Railway follows the west branch toward Truro—this company has commenced an extensive furnace and plant. The site, between the two branches of the river, selected by Mr. Gilpin, Inspector of Mines, nearly twenty years ago, as the future scene of iron making, presents every advantage—abundance of water, proximity to the main line of railway, unlimited supplies of flux on the ground, and a favorable terminus for a line of railway along the east branch to the iron mines some ten miles away Their furnace will be sixty-five feet high, and the blast will be heated by three hot-air stoves, a volume of 15,000 feet of air per minute being supplied by two blowing engines of 1,000 horse-power. The production is expected to be 100 tons a day. Coppé ovens have been built—it is said the first of their kind in America—capable of yielding 75 tons of coke a day. The slack coal for the coke will be washed, so that the percentage of impurity in the coke will not exceed 8 per cent. This brief reference will indicate that the plant is first-class and well planned. The railway is now completed to the mines at Springville and Sunny Brae, where preparations have been made for ample supplies of limonite, red hematite, etc.

Some local capitalists have started the Pictou Charcoal Iron Co. to make charcoal-pig car wheels, special machine castings, etc., from the limonite ores and charcoal of the East River district. Their works at Bridgeville, on the line of the New Glasgow Co.'s line, are rapidly nearing completion. They embrace a furnace some 50 feet high, calculated to yield 5,000 tons a year, a foundry, kilns for charring the wood from some 6,000 acres of woodland acquired by them, etc., and a number of valuable iron ore beds. In addition to these properties, already turning out more valuable than at first anticipated, there are two other large properties containing immense quantities of ore.

Surveys are now being made with a view to extending a railway from this district to Country Harbor on the Atlantic coast. The scheme embraces both the export of raw ore, as well as smelting works. From the unusual facilities offered here for smelting iron ore, it is believed that the estimates putting the cost of a ton of pig iron in Pictou county lower than in the much vaunted Tennessee districts of the United States are well founded. It is anticipated that the high grade of the pig made here will permit of its introduction into the United States, and there is no doubt but that in the event of a lowering of the tariff there, a market will be afforded for every ton Pictou furnaces can produce.

In the meantime the prudent promoters of these young enterprises see a home market secured for their products. The Steel Co. of New Glasgow and local foundries will absorb a large percentage of the output, and the steadily increasing demand for iron for structural purposes will go far to absorb the remainder. The field is still open for further operations, and the next investors will have the advantage of a railway already built into the centre of the iron ore district, estimated at over 200 square miles in extent, and the experience gained by those now at work.

The field open to the iron makers of Pictou, in an equally congenial occupation, is that of iron ship-building. Every year sees the purchase of steamers in England for the coast trade of the Atlantic and the Gulf of St. Lawrence. These steamers of moderate tonnage could nowhere be built to better advantage than on the East River of Pictou. The old builders of wooden ships could, with equal facility, shape the iron vessels, which for many purposes hold their own against even the ocean tramps, the epitome of cheap transportation. Included in the lines of manufacture parallel to that of ship-building, are: tanks, car iron, mine rails, engines and many forms of iron used in railway work, etc., and the establishment of any large works, for iron vessel building almost insensibly branches into the manufacture of many allied products. These anticipations are not idle dreams, but well within the reach of the shrewd men who have step by step built up the industries of New Glasgow, and are now achieving their successes, not with capital cajoled from foreign investors, but with their own means, invested with discretion and administered with the ready hand of the business man who sees the speedy profit of his venture.

Those Nova Scotia Maps.

When it became known in 1889 that, because of influences brought to bear on him for colonization surveys in other provinces, explorations and work often in no wise related to the proper objects, as we understand them, of a geological survey, the Director had concluded to change the excellent system, pursued by him for nearly twenty years, of a thorough and detailed survey of the foremost province of the Dominion in the matter of mining development and the publication of the results in a map on a scale of one mile to an inch ; and, on the score of economy, to publish the accumulated surveys of the preceding seven or eight years on a scale of four miles to an inch, we did not hesitate to declare that in our judgment a great mistake had been made which would mar the beauty and utility of the work already published, and we characterized the change as a piece of penny wisdom and pound folly.

By one of the characteristic delays of this department, the maps had not been published when ready from year to year but had accumulated to such an extent that the money necessary to publish them all deterred the Director from publishing them at all except on this scale, admitted by those who have examined it as inadequate to represent the work done in that time in the district surveyed.

At that time we contemplated taking the step afterwards taken by the Gold Miners' Association to get the opinion of mining men of the Province on the subject ; but we desisted when told that the minister would look into the matter and set it right, as a petition to that effect was presented to him by all the members of parliament from Nova Scotia a few months later. It was urged that as the Province of Nova Scotia was deemed of such importance that two out of fifteen or twenty of the field geologists on the staff were sent there every year at an annual cost of more than $5,000, and as the survey itself was the chief item, and the publication of the maps only a small part of the total cost, and as the publication of the work of these parties for all this time had so far cost the department little or nothing, means should be taken to publish the accumulated work of these eight years and in the future to keep the publication up to date ; for it seemed reasonable to suppose that the sum of $6,000 stated to be necessary, could easily be devoted for that pur-

pose out of an annual grant of more than $100,000, or if not that it could be spread over two or more years. Even the omission of the frequent photographic views of scenery which, in the opinion of the committee of 1884, "should absorb no prominent part of the attention of a field party sent out to study the geology of the country, and certainly should occupy no portion of the published reports" would probably much more than save the annual cost of such maps.

A cheaper process of printing was recommended in the petition, and it was ascertained that by making the sheets of a size of 24 ins. by 20 ins. instead of 18 ins. by 12 ins. the cost of publishing for ten years to date can be reduced to less than $6,000 without changing the delicacy and accuracy of the lines, as would be done by the process of photo-lithography, which was also suggested, but which requires exceptional skill in the draughtsman and as much time as would be spent by an engraver in lithographing them.

But no notice was taken of this petition by the Minister of the Interior, who followed, instead, the "peculiar judgment and temper of the Deputy Head" with whose obstructive powers he did not care to interfere; and one of the sheets has been issued on the scale against which the members of parliament so strenuously protested, with the result criticized in our last issue by a correspondent who but echoes the wish that "these and other points may soon be so clearly put to our people that the government may find no difficulty in dealing with the matter."

Representations have also been made to the minister by the whole mining community of Nova Scotia, by the Gold Miners' Association, the Nova Scotia Institute of Science, and others. These also have been disregarded by the Minister, or rather a reply was made for him by the Director that if the Nova Scotians required these maps the Provincial Government should bear part of the expense of them—should in other words do what is the plain duty of the Survey and publish a map of some economic value, that would, while making no claim to being perfect or final, embody the information we possess, and present any new information that may be obtained, in such a form as would be useful to the mining interest of the country, and a number of useful details which, if not always understood, will help to interpret obscure points in the geology. The government of Nova Scotia has always been most liberal in its expenditure on behalf of its mining industries; but to publish these maps is not within its functions, but is the duty of the Geological Survey.

We have always insisted that if the Survey cannot be made of value to the mining interests of the country its chief end is unfulfilled. That its chief value to Nova Scotia lies in the maps has been strongly urged by the Inspector of Mines and many others, and by none more strongly than the Director. Nova Scotia is surely entitled to a certain portion of the appropriation for publication as well as for surveys; but whereas the annual expenditure is from $14,000 to $15,000, Nova Scotia, for the years 1882-1885, seems to have got less than $300, and since then little or nothing, while large plans and reports on the Northwest, British Columbia, and other parts of the Dominion, showing necessarily much less detail than the maps in question and often the results of rough track surveys, have been pub lished at great expense, as may be seen by reference to the annual reports of the Geological Survey and to the public accounts.

The policy of this department in the matter is characterized by the Antigonish *Casket* as like that of "putting down an expensive foundation for a house and then building a shanty upon it." In order to carry out the detailed system of investigation which, on account of the position, smallness, variety of geological formation, and extensive industrial mineral deposits of Nova Scotia—which produce one third or one quarter the total mineral yield of the Dominion—is admitted to be necessary, each party spends a season in a district of only from 200 to 500 square miles; or say that the two parties survey 800 square miles. The Minister of the Interior (Hansard Report, June 18th, 1891) has informed the House that each of the published sheets is to cover 3456 square miles; we must therefore wait four and one third years for one sheet, and five such sheets will embrace the whole area of the province. Until now this has been always taken into consideration; and when the government of Nova Scotia in 1880, by a supplementary grant, assisted in the work, the scale of the general map of the gold fields—which occupy nearly half the province—was enlarged to half a mile to an inch. For if the large scale found little to be said in its favor for Cape Breton, much can be said for it in the five counties already surveyed on the mainland in favor of keeping these sheets uniform with those of Cape Breton and of issuing them as soon as ready. But instead of following the average agreed upon, it is now proposed to follow a rule something like: Expenditure for map to be in the inverse ratio of delicate accuracy in survey and public interest in the locality.

Is not the suppression of these maps on the score of economy like a repetition of a case to which attention is called on page 75 of the report of the Committee of the House of Commons on geological surveys, 1884, in which one man was asked to get his report into a dozen pages and certainly not to exceed twenty, while another published a report of 239 pages, illustrated by three maps, fourteen plates and other figures, representing two and a half months' work mostly on Indians! It seems to fully justify the charge of lack of system in the administration of the department brought against it by this committee and others.

We append the correspondence from the leading mineral operators and others submitted to the Minister of the Interior by the Gold Miners' Association in its appeal to have this matter rectified. In the supplement, also published with this issue, our readers will find a clear demonstration—if any is required—of the absurdity and inutility of Dr. Selwyn's four mile to the inch map. Mr. J. F. Stairs, M.P. for Halifax, is pressing the matter in the department, and if no assurance is given that maps will be amended to the scale of one mile to the inch, will bring the matter up in parliament.

HALIFAX 10th Oct., 1891.

J. F. Stairs, M.P.,
Ottawa.

SIR,—The enclosed memorials and attached letters speak for themselves. The Gold Miners' Association of Nova Scotia asks of you and Mr. D. C. Fraser, and your other colleagues from Nova Scotia, that you will present the same to the attention of the House, and that, in the interests of Nova Scotia's welfare, both parties may unite in succoring an industry so vital to the welfare and prosperity of Nova Scotia as is her mining industry.

Yours truly,
(Signed) H. M. WYLDE,
Secretary.

Copy of Memorial by the Gold Miners' Association of Nova Scotia, addressed to John F. Stairs, M.P., of Halifax, and D. C. Fraser, M.P., of New Glasgow.

Whereas the Geological Survey of Canada has already published a most admirable map of Cape Breton upon the scale of one inch to the mile; and whereas some portions of the mainland have already been surveyed and plotted upon the same scale, with a view to like publication; and whereas the publication of such portions in sheet form has been delayed because of the single desire of the Director of the Survey to have these portions reduced to a scale of four miles, thus stultifying the excellent and minute character of the field work, and rendering the maps of little or no economic value to the mineral industries; and whereas the concensus of opinion of the administration of the mining industry in Nova Scotia, and others, as shown by the letters hereunto attached, is in favor of the larger scale. Now, therefore, for themselves and their associates, by their President and Secretary, the Gold Miners' Association of Nova Scotia do respectfully, humbly, yet urgently, petition your honourable selves and your honourable colleagues from this Province to bring this matter as quickly as possible to the attention of the Federal Government, and to urge upon the proper department thereof the necessity for publishing these maps upon the scale, as originally drawn, of one mile to one inch, and do further respectfully request that such representation and such demand be made as voicing the unanimous desire of Nova Scotians for the further prosperity and benefit of their Province.

We are,
Yours truly,
(Sgd.) J. M. REID,
President,
(Sgd.) H. M. WYLDE,
Secretary.

To the Secretary of the Gold Miners' Association.

SIR,—I am in receipt of your favor of the 23rd June, asking for an expression of my views as to the desirability of the maps of this Province now being made by the Geological Survey of Canada being published on a scale of one mile to the inch or on a scale of four miles to the inch.

Having had considerable experience in surveying and mapping, for the Government of Nova Scotia, several of our gold districts—Waverley, Mount Uniacke, Montague, Renfrew, Sherbrooke, Oldham—I am able to give expression to my views with decision and emphasis.

1. In making a preliminary examination of any gold mining district in Nova Scotia, the first want experienced by me was a correct topographical map or plan of the country. That this is essential to needful information is apparent from the existence, in every gold mining district I have examined, of a great fold or anticlinical and numerous faults and dislocations, which, in many instances, disturb the continuity of strata and veins to the extent of many hundred feet. Without correct topography folds and dislocations cannot be delineated, and prospecting cannot be successfully carried on except at great expense. The folded structure of the strata in Nova Scotia, coupled with the occurrence of great dislocations, so disturbs the continuity of veins and groups of veins, that unless the topography is represented on a large scale, widely separated groups of veins, some originally continuous, often cannot be identified.

2. The gold in Nova Scotia, so far as known to me, occurs at three different horizons, which may be designated as the black slate (the lowest), the whin and slate belt (next succeeding) and the fossiliferous bird's-eye and Black River limestone (supposed) of the New York Survey, lying far above the Cambrian, whin and slate belt. The last two are the most important. A correct topographical map on a scale of one mile to one inch, is the lowest limit, to my mind, which would be of service to the gold mining industry of Nova Scotia for the display of the outcrop of these rock systems.

3. The first step to a general knowledge of the probable gold-producing capabilities of Nova Scotia appears to be

a wide publication of a topographical map which would enable a practical field geologist to lay down with accuracy, as determined from time to time, the limits of the three recognized gold-bearing series in the Province. This could not be done well or profitably on a less scale than one mile to one inch. This scale is the least which would allow of the main foldings and dislocations to be subsequently portrayed, and it is near the line of some of these foldings and dislocations that the gold districts lie.

4. The fossiliferous rocks (birds-eye and Black River limestone, supposed) I traced last year for about twenty miles. They contain gold-bearing veins in several places. The auriferous outcrop is tortuous, and, owing to the absence of a topographical map on which any reliance could be placed for the purposes of a geologist, a wide and very promising field remains practically unexplored. But with an accurate topographical map on a scale of one mile to an inch, rapid and probably important work could be done by any trustworthy and conscientious amateur geologist.

5. I think that the gold in the fossiliferous rocks of the Province differs in colour and purity from the gold in the Cambrian whin and slate. It is, geologically, from twelve to sixteen thousand feet vertically above it. Its occurrence in Rawdon and Newport townships is of considerable importance, for it may be that from the debris of rocks of the same age much of the gold found in the auriferous conglomerates has been derived. The outcrop of these rocks together with the auriferous conglomerates cannot be delineated for practical purposes on a topographical map of less scale than one mile to an inch. For these and other reasons it seems to me very desirable that every proper effort should be made to secure the publication of the geological map of Nova Scotia on a scale of one mile to one inch. These maps would then be on the same cale as the valuable and beautiful series published by the Dominion Geological Survey delineating the geology of the Island of Cape Breton.

Very truly yours,
HENRY YOULE HIND,

WINDSOR, N.S., June 25th, 1891.

COW BAY, C.B., July 14th, 1891.

H. M. Wylde, Esq.,
Secretary Gold Miners' Association, Halifax.

DEAR SIR,—My absence from home will explain my not replying to yours of the 23rd ult., and it is a pity you did not direct your letter to the secretary of the Cape Breton Coal Association at North Sydney. Mr. McKeen, our M.P., is a member of the Association, and I will write him on the subject and trust that your request may be granted.

Yours truly,
CHARLES ARCHIBALD,
Managing Director Gowrie Coal Co.

HALIFAX, N.S., 24th June, 1891.

H. M. Wylde, Esq.,
Secretary, Halifax.

DEAR SIR,—With reference to your circular about the Geological Survey maps, we consider it would be a great mistake to have them made on a smaller scale than a mile to the inch. In conversation with Mr. Gilpin, the inspector of mines, he expressed himself very strongly on the subject, saying that we had only to refer to the maps of Cumberland county, which he considers not only useless but misleading. We sincerely hope that you will be successful in having these maps made on a scale of an inch to the mile.

Yours truly,
S. CUNARD & Co.,
Agents General Mining Association,
of London, Eng.

DRUMMOND COLLIERY, WESTVILLE, N.S.,
June 25th, 1891.

H. M. Wylde,
Halifax.

DEAR SIR,—Yours of the 23rd inst. to hand. With reference to the provincial survey now being made, I think it should not be less than one mile to the inch to be of practical utility.

Yours faithfully,
CHARLES FERGIE,
Manager, Intercolonial Coal Co.

LONDONDERRY, N.S., June 27th, 1891.

H. M. Wylde, Esq.,
Secretary Gold Miners' Association, N.S.

DEAR SIR,—To the explorer and practical miner a geological map on the largest possible scale is of the greatest importance.

The excellent work already done by the Geological Survey would be much impaired by a reduction of map to a scale of four miles to the inch.

Yours very truly,
R. G. LECKIE,
Manager, Londonderry Iron Co., Ltd.

SYDNEY, C.B., June 26th, 1891.

H. M. Wylde, Esq.,
Secretary Gold Miners' Association,
Halifax, N.S.

DEAR SIR,—I am favored with yours of the 23rd inst., and am of opinion that the proposed survey of this Province upon the scale of one mile to the inch, would be infinitely better than one of four miles to the inch as proposed.

Yours truly,
D. J. KENNELLY,
Agent and Manager
Sydney and Louisburg Coal and Railway Co.

SYDNEY MINES, C.B., NOVA SCOTIA,
June 27th, 1891.

H. M. Wylde, Esq.,
Secretary Gold Miners' Association of Nova Scotia,
Halifax.

DEAR SIR,—I have received your circular-letter of 23rd inst. this morning.

In reply I beg to say that in my opinion it is very desirable that the survey maps of the Province of Nova Scotia should be published on the scale of one mile to the inch. I believe it would add greatly to their usefulness to have them on such sized scale, and I have no objection to my name being used in connection with such views.

Yours truly,
R. H. BROWN,
Manager, General Mining Association
of London, Eng.

NEW GLASGOW, N.S., July 2nd, 1891.

H. M. Wylde, Esq.,
Secretary Gold Miners' Association,
Halifax, N.S.

DEAR SIR,—Your circular of the 23rd June was received in my absence.

I think it would be a pity for the Government to waste money in making a map on so small a scale as four miles to an inch. I think the map should be at least four times that size to be of any practical use.

Yours very truly,
GRAHAM FRASER,
Vice-President, New Glasgow Iron, Coal
and Railway Co.

STELLARTON, N.S., July 2nd, 1891.

Messrs. The Gold Miners' Association—
H. M. Wylde, Esq., Secretary,
Halifax.

GENTLEMEN,—In answer to your enquiry of June 23rd, I have much pleasure in stating I am in hearty accord with your movement to have the maps of the Geological Survey in Nova Scotia published on a scale not less than one mile to one inch. I have before me maps of the coal and iron fields of this county on this scale, and I have no hesitation in saying that maps on any smaller scale would be of little or no practical value. That this request of yours is not unreasonable may be fairly assumed when it is remembered that the whole of Cape Breton is published on this scale, and that the cost in excess on such a scale as four miles to one inch would be but trifling in comparison with the cost of procuring the necessary information in the field.

I am, Gentlemen,
Yours respectfully,
HENRY S. POOLE, F.G.S., A.R.S.M., &c.,
Mgr. Acadia Coal Co., Ltd.

OTTAWA, July 13th, 1891.

H. M. Wylde, Esq.,
Secretary Gold Miners' Association,
Halifax, N.S.

DEAR SIR,—Your favor of the 23rd ult. arrived here during my absence at Cape Breton. In reply I may say that maps of the geological survey of Nova Scotia, made on the scale you suggest, of one mile to the inch, would be much more satisfactory than any that have yet been published. Maps made on a smaller scale, or four miles to inch, are, in my opinion, of little practical use.

I am, yours truly,
D. MACKEEN,
M.P. and Mgr. Caledonia Coal and R'y Co.

OTTAWA, July 11th, 1891.

DEAR SIR,—I have the honor to acknowledge receipt of your communication of the 23rd ult., asking an expression of my views as to the desirability of the maps now being made by the Geological Survey of Canada being issued on the scale of one mile to the inch or upon the scale which it is understood the Department at Ottawa are contemplating, namely, four miles to the inch.

In reply, I may say it is my opinion it is desirable the maps should be issued upon the scale of one mile to the inch.

Yours faithfully,
JOHN F. STAIRS.
M.P. for Halifax.

H. M. Wylde, Esq.,
Sec'y Gold Miners' Assoc'n of Nova Scotia,
Halifax, N.S.

The Phosphates of America.

Following the work on this subject by Francis Wyatt, Ph.D., and which was noticed in the issue of the REVIEW for December last, we have another book now publishing in London, England, and compiled by Mr. C. C. Hoyer Millar, who is well known in the various phosphate fields and to the commerce of fertilizers in Europe and America. The scope of this work is thus defined in the Preface:—

"Although there is an abundance of literature upon the subject of the geological formation and chemical analysis of the various phosphates which have hitherto been discovered, yet it appears to me that the practical, though possibly sordid, side of the question has been rather neglected.

"Since, however, the phosphate mining industry is being carried on with the primary intention and hope of obtaining satisfactory returns from a pecuniary rather than a scientific point of view, I have ventured to give in the following pages an account, from a practical standpoint, of my personal investigations during the past few years in the phosphate fields of Florida, South Carolina and Canada. The book is therefore addressed to those who are commercially interested in phosphates, and should it be the means of giving them fuller information than they would be likely to gather elsewhere, then my efforts will be amply rewarded."

The work comprises 223 pages and is apportioned to the following chapters: I. Introductory, treating of the importance of phosphoric acid in nature; the sources of supply, and the classification of mineral phosphates.

II. Florida phosphates: treating of the Peace River phosphate; land pebble mining; the rock deposits; rock mining, and gravel rock mining.

III. South Carolina phosphates: mining of the land and river phosphate respectively.

IV. Canadian phosphates.

An appendix briefly treating of the remaining principal phosphate and guano fields of South America and Europe.

We shall confine our present remarks to chapter IV. and Canadian phosphates, which Mr. Millar deals with in order under the following heads: Geological formation—Description of the Mining Operations—Analysis—Preparation of the Ore—Transport—List of companies operating in 1891—Cost of Production—Shipments—Price of Phosphate Lands—Present Position and Future of the Industry.

The author deprecates the method of contract work formerly effected by farmers in the Ontario district, but adds: "Yet it is probable that these early days and primitive methods resulted in greater gains to the owners of properties than the more recent and regular operations;" and he justly attributes "the erroneous idea prevalent in Europe, that the apatite in the Ontario district is found in shallow pockets only," to this crude method of surface-working formerly carried on by the farmers and land owners.

The principal working mines of Ottawa County are separately referred to, and their dis-

tinguishing character of "capriciously occurring pockets of varying extent," compared with the more regular and vein-like formation of the Perth and Sydenham districts of Ontario.

Speaking of the proportion of marketable ore to the total ground broken in Ottawa County, the author's observations gave the maximum of 25 per cent., and a minimum of one unit, and he considers that anything over 10 per cent. is exceptional, while the probable general average is little if anything over 5 per cent. The average was more favorable in the Ontario mines, where from the vertical fissure, or vein-like banding of the mineral, the ore is sometimes "extracted without removing any appreciable quantity of other matter from which it is entirely distinct."

This average yield of marketable ore has been, and will always be, a very difficult question to answer satisfactorily. The investor naturally enough demands of the expert: How much phosphate is in sight? or: How much phosphate can be relied on per annum? Surmising that our deposits can be gauged with reasonable exactness, as is usual with coal seams, or well-defined metallic veins, Mr. Millar has, we think, fairly estimated the results attained by the mining in Quebec as hitherto effected.

The present manner of "cobbing" or preparing the ore for market, is shown to have developed from the forced high-grade guarantee of 80 per cent. minimum, and the large proportion of "seconds" falling below 70 per cent. attributed to the system of the free use of explosives in confined underground spaces, when, if the phosphate be at all friable, it is broken up almost into powder and irreparably lost.

It is surprising that so little common sense progress has been made in this respect, since a judicious use of black powder, when working in ore ground, would not only avoid this deplorable waste of first-class quality, but be an actual economy in working cost.

The cost of production is taken by Mr. Millar at $9 per ton at the mines, that is to say exclusive of transport, which may average $3.81 per ton more, and thus giving the total cost f. o. b. Montreal of $12 to $13 per ton.

The prices realized ex-ship in Europe for the various grades of Canadian apatite of 60, 70, 75 and 80 per cent. respectively, over the years 1882 to 1891 inclusive, are quoted, and the fact of the lower qualities not realizing prices in proportion to the value of the first quality is thereby demonstrated, while it is worthy of note that during the last two seasons (1890, 1891) the average value at the mines of 70 and 60 per cent. qualities, was about $6 and $3.50 respectively, showing a very serious loss of production. "If, then," Mr. Millar remarks, "the first quality ore has to provide for the loss upon the other two qualities before the possibility of making any profit can be arrived at, it follows that in order to make such an enterprise a success the proportion of first quality ore to the whole must be a high one." Unfortunately just the opposite is the case!

The author calls merited attention to the prices of phosphate lands, mentioning some of the exaggerated figures obtained on the du Lièvre River properties, and puts his own views of the subject on record. These are so interesting that we quote them verbatim.

"In order to arrive at a valuation, the following points have to be considered:—

(1.) Possible annual out turn and profit.

(2.) Amount of capital required to be invested for that purpose.

(3.) Chances of getting back original cost and outlay of plant.

"With these points before us and with the full knowledge of the geological formation of these deposits, and with the results of the various mining undertakings hitherto established, we say unhesitatingly that we do not know of any undeveloped property in Canada for which we could recommend more than £5,000 as a maximum for the purchase of a one-half interest, and this figure is far beyond the entire value of most of the undeveloped properties which we have explored. Turning now to the question of developed properties, these should only be bought upon a valuation of the money spent upon plant and developments, and upon the quality or reserves of ore actually in sight, for what lies hidden is an uncertain quantity.

"The most satisfactory method of operating a property would be upon a royalty of so much per ton extracted.

"These are our views to-day, but it must be understood that a few years ago the position and value of Canadian phosphate properties stood upon a totally different footing. The discoveries in Florida of large quantities of high-testing phosphate, capable of being easily and cheaply mined, have altered the relative value of Canadian lands most materially; for whereas some years back, Canada and Norway were recognised as the only countries capable of producing high-testing phosphate, and that only in small quantities, an enormous new field with illimitable supplies has now been put into active operation."

The paragraphs devoted to "The Present Position and Future of the Canadian Phosphate Industry," will be eagerly investigated by those interested in this industry. We fear that it is only too true that the unexpected development of high testing phosphates in Florida have caused a temporary, if not a lasting disaster to Canadian phosphate investments. We were wont to deceive ourselves by concluding that as we possessed the richest grade in the market, we could always stand in an independent and unassailable footing against all comers, but we did not sufficiently appreciate the fact, that it is the *quantity* and not the *quality* which establishes the market value. Canada attained the maximum yearly output of 30,000 tons in 1890, but according to the statistics published by the *Engineering and Mining Journal* of New York, Florida produced 159,000 tons last year, being its second year of development. We are of the opinion that the latter estimate exceeds the actual production, but admitting, say 100,000 tons, and the argument still holds good. As a consequence of unremunerative prices Canada fell off 33 per cent. in last year's shipments, and the present year promises a still more alarming decrease in output. Now unfortunately our average cost of production in Canada considerably exceeds that of most other working fields, and certain Florida producers can, for instance, put the ore f. o. b. rails, at $3 per ton. Canada has the high grade article, but has to dispose of it at a market price governed and established by the more abundant and more cheaply producing fields of supply.

What then, asks Mr. Millar, must be done to keep the Canadian industry from dying out and to prevent the total loss of the heavy capital invested? and he solves this problem by proposing to abolish the present system of "cobbing," which is one of the heaviest expenses in the total production, and would produce only two qualities by a direct method of careful mining, *i.e.*, 80 per cent. and over made by a judicious use of explosive, and direct selection in the mine, and obtaining a residue of, say 62 per cent., this latter class should be ground on the spot and either dispatched to the available markets in the United States or transformed locally into superphosphate. This opinion agrees with the expressions of Dr. Wyatt in his lately published work above referred to, and appears to us to be rational and perfectly feasible.

Referring to the manufacture of superphosphates in Canada, Mr. Millar admits that at the present time only a few hundred tons of fertilizers are used per annum, but adds that the example of other wheat-growing countries must be imitated ere long. This is a big subject, which we must leave for the present.

In resuming, we consider that the work before us has kept well in view the lines laid down in the preface, and without any pretention to confuse the ordinary reader in scientific theories, which in nine cases out of ten he cares nothing about, the author has massed together the well-weighed facts of a practical observer, and the investor or exploitant will find the information here furnished both explicit and reliable, while the practical standpoint has been thoroughly maintained throughout the book, which should therefore prove to be a most useful work of reference for those seeking commercial and practical information on the phosphate fields of America and their possible development.

Nitro-jute is a new explosive, invented by Mr. Otto Muhlhauser. He treats one part by weight of jute fibre with 15 times its weight of a mixture of nitric and sulphuric acids. This product, which weighs about 30 per cent. more than the original fibre, takes fire at a temperature of 167 to 170 degrees C., and contains about 12 per cent. of nitrogen. It is of a brownish-yellow color, and the composition is given by the author as C_{12}, H_{15}, O_5, (ONO_2). It explodes by percussion like gun cotton, and is insoluble in water, ether, benzine or alcohol, but dissolves readily in acetic ether and nitrobenzine.

EN PASSANT.

The Council of the General Mining Association of Quebec will be received by the Hon. the Commissioner of Crown Lands, at the Parliamentary Buildings, Quebec, on Thursday, 31st instant, when a new Mining Act for the Province will be discussed.

Dr. Bell's long-looked-for report of the Sudbury district is at last issued. Those who have been anticipating a valuable contribution of economic interest will be disappointed, the volume being almost wholly of geological and technical value. A good map accompanies the report.

By the way will the Director of the Geological Survey kindly give us some information of the whereabouts of the long-promised report and map of the phosphate districts? It is now more than three years since this work was begun, and the map was understood to be ready for the public more than a year ago. More light please!

Apropos of the subject of maps reminds us that Mr. J. Obalski, M.E., Government Inspector of Mines at Quebec, and Mr. E. J. Rainboth, D. and P.L.S., have both lately published maps of some value to the owner and operator of phosphate lands in the Province of Quebec. Mr. Obalski's map will be of particular service to investors, inasmuch as it shows the Lots already sold and those still held by the Government.

A fair indication of the demand for mining lands is shown by the report of the Director of Mines for Ontario, which will be issued in a few weeks. The total number of patents issued during 1891 for mining lands in the Province was 289, covering 59,389 acres, for which the Government was paid $117,514. Of these 289, 46 were for the Rainy River district, 72 for the Thunder Bay district, 130 for the Algoma district, 20 for Nipissing and 21 elsewhere. The new leasing clause of the Mining Act, which came into force in May of 1891, has been largely taken advantage of, for since that time until the present (ten months), nearly seventy-five leases have been granted, comprising about 8,000 acres, the first year's rental paid to the Government aggregating nearly $8,000. A consolidation of the mining laws of the Province is promised during the session of Local Legislature now being held.

A mining school at Ottawa becomes a possibility under the provisions of the Mining School Act of 1891. If the city will give $5,000 a year for maintenance and the counties on the Ontario side of the Ottawa $5,000 each for building and plant the thing can be done. The Provincial Government may be expected to establish in connection with the school a laboratory for the eastern part of the Province and to pay the salary of an assaying chemist who would be on the teaching staff. Ottawa has special advantages to offer in its supply of unlimited water power for electrical purposes in connection with such a school. The most advanced metallurgists admit that the practical advance of their art lies in the direction of the extended use of appliances for electro-fusion and for the dissociation of natural mineral compounds by electrolysis. It will be easy to place a Mining School at Ottawa in the forefront of institutions where a knowledge of electro-metallurgy can be obtained. By relationship, as the headquarters of the geological survey and the place at which yearly congregate for a time the representatives of all the mineral sections of the Dominion, Ottawa has advantages to contemplate in the possession of such a school which no other place may dream of. Besides all these pleasing anticipations, is it not the case that there is here a degree of interest in mining affairs not second to that of any city in the Dominion.

It is needless to say that the fourth Annual General Meeting of the Gold Miners' Association of Nova Scotia, at Halifax, on the 30th instant, was a success. The greater portion of the day was spent in discussing and suggesting important amendments to the Mining Law, most of which, we are glad to say, there is reasonable prospect of being adopted by the Government. The dinner, entirely *sans ceremonie*, was in every sense worthy of the good fellows who sat down to it. The music, songs, witticism, drollery and fun of the occasion will linger long in the memory of those who, like ourselves, were privileged to be present at the feast.

In another place our Cape Breton correspondent condemns the proposal of the Nova Scotia Legislature to increase the royalty on run of mine coal. The case is clearly stated.

A probable increase in the coal royalty has been known to the trade for some time, and has been casually discussed by a few of the colliery managers before the Executive Council. The local Government is hard up and thinks it sees an easy way to add to its revenue by simply adding 2½ cents per ton on the coal royalty. The coal interest is, unfortunately, not organized, and unless some move such as that proposed by the Gold Miners' Association is carried quickly into effect, the opposition which this increased royalty naturally creates, will be but individual; it may be general but it is not likely to have the weight which combined representation, forcibly put, would have before the Committee of the House of Assembly.

The views of the trade may be summarised in the following excerpts from a letter received from one of our largest colliery operators:—

"A large amount of capital has been sunk in the coal industry of Nova Scotia—a capital that has not paid an average of 2 per cent. to the adventurers, while the Province has very largely benefited by the circulation of the cash paid to the workmen and the royalty to the Government. The investors risked their money in the ventures in good faith, and when they got a lease given in the Queen's name they trusted that good faith would be kept with them. It is now contended by the present Government that the general acceptation of the terms of the lease has been incorrect: that the royalty is not, strictly speaking, fixed for a term of years, and that by legislation of 1886 the Government has the right to alter the rate of royalty under all the leases at will. If they have, honest investors had better 'stand from under' Nova Scotian mines, for once let the impecunious local Government find they have in the coal operators an orange they can squeeze at will, and they once taste blood, where will the end be?"

More forcible and no less direct are the views of the managing director of a Pictou county company, who writes:—

"I was notified yesterday that the Nova Scotia Government intend passing a bill increasing the royalty on run of mines coal from 7½c. per ton to 10c per ton. They have the power to do so; but it is monstrous to attack an industry which has yielded them so large a revenue, while the unfortunate investors induced to go into the Province seldom see anything in the shape of a dividend. Government discouragement to investors by present mining laws is a little strange."

The coal mining industry of Nova Scotia is far too important a factor in the welfare of the Province to be saddled with any burdensome restriction of this kind. The Government has everything to gain from its widest possible extension, and by the introduction of fresh capital to develop its virgin areas but this assuredly will never take place so long as the companies are to be made the target for every revenue-producing scheme that may strike the fancy of the legislature. The Hon. Mr. Fielding, whom we esteem and admire, has so far endeavored to meet the mining community in a fair and friendly spirit, and his mining legislation has been distinctly in advance of any of the other Provinces. In the present proposition he emphatically takes a step to the rear.

This emergency is the coal miners' opportunity to organise. Without unity of action they can do nothing. We heartily commend to them the proposition of the Gold Miners' Association to unite the whole mineral interests of the Province into one strong representative body. Experience in Quebec has proved beyond a peradventure that this is the best method to protect and promote the welfare of the mining industry. We hope to record in our next issue that such an organization has been carried into effect.

Apropos of the question to increase the royalty on run of mine coal Mr. Cahan, the leader of the Nova Scotia legislature, has asked for the following pertinent return, showing:—

1. The amount of coal royalty due from each coal mine or mining company in Nova Scotia on December 31st, 1885.
2. The annual output of each mine as duly declared by the officials of said mining company in each year on which royalty could be lawfully exacted, or collected in each year since December 31st, 1885; also a similar statement showing the output of round and slack coal in each year from each mine.
3. The amount of coal royalty paid by each mine or mining company to the provincial treasury during each year from December 31st, 1885 to December 31st, 1891.
4. The amount of coal royalty due or uncollected from each mine or mining company in the Province on December 31st, 1885, 1886, 1887, 1888, 1889, 1890 and 1891.
5. Copies of all orders in council passed since December 31st, 1885, providing conditions under which coal royalty from any mine or mining company in the Province, or providing for any rebate or remission of royalty due in favor of any mine or mining company.

These returns should furnish in themselves the very strongest argument against any further imposition of taxation upon the coal producer.

The use of pure nickel in the manufacture of liquid measures in France is made legal by a decree of Jan. 30, 1892. Within three months after the issuance of this decree no pewter measure will be accepted for official verification containing in their composition over 10% of lead or other metals ordinarily found in the pewter of commerce.

The *Coal and Iron Trades Journal* is our authority for the following paragraph, of interest to Canadian producers of nickel:—

"A company has been formed at Havre (France) for the manufacture of nickel. It is having a factory constructed on the Tancarville Canal, and has concluded an important contract with the government for nickel-plating Lebel rifles. The mineral used has hitherto come from New Caledonia, but is henceforth to be imported from Canada."

Nickel-steel armor plates, of English make, are discussed in the late report of Lord Hamilton, First Lord of the Admiralty. Two firms have produced 10 ½in nickel-steel plates, and their tests are said to compare favorably with those of the same type of plate made in other countries. Extensive orders have been placed for the use of this armor in the secondary defence of battle-ships. But for greater thicknesses than three or four inches, says Lord Hamilton, the inquiry is not yet sufficiently complete to warrant its adoption. Its manufacture is, however, being widely extended under the liberal patronage of the British Admiralty.

Returns from the Dominion lands agents show that during the past year twenty entries were made for mining locations other than coal. The total area of mining locations sold in the North-West Territories up to date is 1,152.56 acres, which realized $5,846.50. All minerals, with the exception of coal, on Dominion lands within the railway belt in the Province of British Columbia, are now administered under the mining laws of that Province. This is in accordance with an arrangement made between the Federal and Provincial Governments, and ratified by Orders in Council dated the 11th and 28th of February, 1890. The agreement may be terminated at any time by either Government.

We presume that one of the first economies of the new Quebec Government will be the immediate dismissal of the retinue of useless political proteges and "hangers-on" in the Department of Crown Lands, notably these worthies ironically dubbed "mine inspectors." If we are to have official mine inspection—and everyone will admit that it is eminently desirable if efficient—let us have men whose qualification will be something more than effete shoemakers or played-out political hirelings. One competent inspector is amply sufficient for the requirements and present status of the industry anyway.

One of the many surprises in store for Mr. Mercier and his gang of unscrupulous "boodlers" was the utter rout of their representative in Ottawa county. Rochon, the late Liberal member, held the seat by close upon a thousand votes, but at the late election was wiped out by Tetreault to the tune of four hundred. Needless to say the Conservative member was materially assisted by a solid mining vote. A very great deal of his success was due to the indefatigable exertions made on his behalf by Mr. S. P. Franchot, the genial and burly vice-president of the General Mining Association. S. P. worked like a Trojan, sparing nothing to secure the return of honest government and a wise mining policy. He has earned, if nothing else, the gratitude of the whole mining interests of the county.

That the mining interest was very much in evidence at the late election is also shown by the return of Mr. James King, one of the vice-presidents of the General Mining Association, for Megantic, by the largest majority ever known in that constituency. The asbestos, copper and other mineral interests went solid for Mr. King. The new member, as everybody knows, holds a very large mining interest in the Province.

The DeBoucherville administration having pledged itself to repeal the obnoxious features of the Quebec Mining Act, its return to power by such a magnificent and overwhelming majority is the subject of congratulation and rejoicing among the mine owners and operators of the Province. It is not unlikely that a deputation from the General Mining Association will wait upon the new Government at an early date to discuss any new Bill that may be projected. Certain it is that no new measure will be thrust upon the mining community in the high-handed and arbitrary manner of its predecessor.

Here is a pointer for the new Government: The mining section of the London Chamber of Commerce, at a meeting held on the 26th ult., unanimously adopted the following resolution:—"That the payment of royalties upon the gross product of metalliferous crown mines is injurious to the industry and to the interests of the country, and that the principle should be adopted for paying the royalties of such mines out of profits."

From a recently issued report on "Strikes and Lock-outs of 1890," by Mr. John Burnett, labor correspondent of the London Board of Trade, it appears that during that period 182,779 persons have, after strikes, received advances of wages to the aggregate amount of £28,193 per week, while 31,078, persons have, by the same means, obtained reductions of working hours averaging two and four-fifth hours per week. But it also is shown that without strikes—that is to say, by negotiation and other amicable ways—225,710 persons have obtained advances of wages amounting to £28,054, while 53,254 persons have obtained an average reduction of hours of two and two-thirds. On the other hand, 10,483 persons, after unsuccessful strikes, have had wages reduced to the extent of £1,082; while, without strikes, 2,639 persons have had wages reduced to the aggregate amount of £566.

From statistics furnished by that model blue book, the Annual Report of the Minister of Mines for New South Wales, we learn much of interest and value respecting the status of the gold mining industry in that prosperous colony. During the year 1890, the producton of gold gave employment to 12,589 persons, of whom 5,597 were Europeans and 707 Chinese operating alluvial ground. The yield of alluvial gold was 58,829 ozs., 12 dwt., 15 grs., that from quartz crushed 58,832 ozs., 5 dwt., 21 grs., or a total gold product for the year of 117,661 ozs. 18 dwt. 12 grs., of a value of £438,249 19s. 3d. sterling. The machinery plant in the various gold mining districts was valued at £459,26 sterling.

The total value of the gold exported from the Province of British Columbia in 1891 was $358,176. 1,199 miners found employment in this industry. The returns for the previous ten years were:—

1881	$1,046,737
1882	954,085
1883	794,252
1884	736,165
1885	713,738
1886	903,651
1887	693,709
1888	616,731
1889	588,923
1890	494,436

The progress of the coal mining industry in British Columbia may be seen at a glance from the following table, compiled by Mr. Dick, the Inspector of Mines:—

	Tons.		Tons.
1888, coal output.	489,300	Exported	365,714
1889, do	579,830	do	443,675
1890, do	678,141	do	508,270
1891, do	1,029,097	do	806,479

The output by collieries was:—

	Tons.
Nanaimo Colliery	527,457
Wellington do	345,182
East Wellington do	41,666
Union Colliery	114,992

Mr. Dick, in his report, speaks most hopefully of the prospects of the trade during the coming season. He says: "Owing to the absence of an equitable reciprocity treaty between Canada and the United States, within the past few months excessive shipments of coal from distant countries to California have so disturbed the balance of supply and demand that existed during the greater part of the past year, that a prudent diminution of output and shipment of coal took place generally from the collieries of the Province, in order to ease off the glut that was brought about by such extraordinary deliveries into California, and it is calculated that early in the spring the market will have assumed its normal condition, and that the collieries of British Columbia will be worked up to their highest power, with a brisk trade, which is a result devoutly to be wished for, on behalf of our very numerous and deserving body of miners in this Province, who have been for some time working only four days or less a week, while their personal, family and household expenses have been going on all the time at full rate. Otherwise, I can truly say that the collieries of Nanaimo, Wellington and Comox were never in better condition than now, and that prospects never looked so well for putting out coal; and it may be expected that after the present lull in the coal market blows off, we shall see every mine worked to its full capacity and to the best advantage of all concerned.

A Cleveland, Ohio, firm has recently constructed an immense coal bucket, 7 feet high, 5½ feet in diameter, and capacity of holding 8,280 pounds of bituminous coal. It tips as easily as the small buckets.

A most important movement for the mining industries of Nova Scotia was made on the 15th of March, when gentlemen representing coal, gold and iron mining, held a meeting in Halifax and made a provisional organization until the 30th inst., for which date a call has been issued for a general meeting of all persons directly interested in the formation of a mining association which shall represent all the various mining and mineral interests of the Province in combination, for mutual benefit and protection. Mr. H. M. Wylde, secretary of the Gold Miners' Association, has consented to act as provisional secretary, and may be addressed at Box 520, Halifax, N.S.

The Kingston Board of Trade has petitioned the Ontario Government to explore and test by means of the diamond drill the veins and ore deposits of the mineral region of the eastern part of that Province. The petition goes on to say:

"Your petitioners respectfully pray that the exploration of the mineral formations carrying magnetic iron ore, phosphate of lime, nickeliferous ores, galena and other economic minerals, may be undertaken by the Province to the extent that the scientific data necessary to guide the capitalist and miner may be as readily procured in this as in other countries where the mining industry is fostered by scientific investigation and education under government auspices."

No public money could be better expended than in an appropriation for this purpose.

In a paper on the subject of "Laurentian Phosphates," read at the Baltimore meeting of the American Institute of Mining Engineers, Mr. John Stewart, Ottawa, makes a suggestion worthy of note respecting the treatment of low grade ores by chemical action, whereby the phosphoric acid might be extracted in soluble form. He says:—

"This suggested process consists in exposing the finely pulverized ore to sulphurous and sulphuric acid vapors, assisted by water-spray. This might be done on a large scale by dropping the fine material through a tower built on the principle of the well-known Gerstenhöfer furnace, but much higher (100 feet would perhaps be a necessary height). The triangular prisms constituting the cross-shelves could be made of acid-proof brick or covered with lead. Other details of arrangement will suggest themselves to those familiar with the operations of the Stetefeldt or the Gerstenhöfer furnace, and need not be elaborated here. Possibly a revolving "cylinder-roaster" might be found applicable instead of the high tower. The action of sulphurous and sulphuric acid when used together in forming the soluble phosphates is more energetic than when either is used separately. The sulphurous vapors required could be conducted to the apparatus from kilns in which the pyrites of the region had been roasted to obtain them; and the reaction in the apparatus could be assisted by adding with the water-spray a little nitric acid. After a simple separation by settlers and buddles of the sand and superphosphates, and evaporating and drying the latter, a concentrated and highly valuable marketable product would be obtained. At Buckingham and Ottawa, producer-gas, made from saw-mill waste, and costing about 12½ cents per 1,000 feet, could be used to aid in washing, steam-raising, and evaporating. Water power is available for mechanical purposes in most of the phosphate districts. If a highly concentrated superphosphate is made, it must be packed in barrels since it is very hygroscopic."

A recent official report from Newfoundland contains some interesting observations on mining in that colony, its present condition and prospects. Owing to the absence of roads through the interior, mining is still confined to within a mile or two of the sea coast. The mines being worked are for copper ores, antimony, iron pyrites, and galena. This industry is yet in its infancy, but the country gives promise of great development in this direction. Ores of antimony, zinc, molybdenite, manganese, chromite, nickel, hematite, gold, silver, etc., are all known to exist; while of the earthy minerals and non-metallic substances there is a great variety, and in many cases an abundance of material; marbles, granites, slates, serpentines, ornamental stones, sandstones, limestones, soapstone and gypsum abound, and asbestos, fluor spar, graphite, mica, etc., are all found. Clays suitable for the manufacture of brick and coarse pottery are abundant. During the past year valuable seams of coal have been discovered in the vicinity of St. George's Bay. Prior to this the St. George's Bay carboniferous area was generally thought to be destitute of coal seams, and as being occupied almost entirely by the carboniferous limestone and millstone grit series. Sir William Dawson, of Montreal, has, however, given it as his opinion that specimens which he has examined indicate a development of the coal measures not unlike that of Eastern Cape Breton, with which the beds may be connected under the gulf, and he adds that the Government of Newfoundland would do well "to inform the English Government of the value of the coal deposits on the west coast and their prospective importance to Britain and Newfoundland as well as to the other colonies. You have the nearest coal to England on this side the Atlantic." Subsequent investigation has brought to light 27 feet of coal, the analysis of which gives a percentage of carbon not inferior to that of Cape Breton coal. This, together with the large deposits of magnetite existing in the same locality, cannot fail, when capital and skilled labour are employed in working them, to add greatly to the prosperity of Newfoundland.

The correspondence recently published in these columns anent Mr. R. H. Ahn has drawn from that voluble worthy a long rigmarole, mostly egotistical, part pugnacious, and bulky enough to completely fill the pages of the present issue of the REVIEW. It has been consigned to the waste-basket.

The total gold yield for Queensland for the past year is stated at 559,392 ounces, the last quarter showing a total of 147,009 ounces, as compared with 139,941 ounces in the September quarter. The year's yield is less by 51,195 ounces than for 1890, but the latter half of the past year shows up with an advantage of 14,503 ounces over the first half. The Charters Towers field contributed 211,605 ounces, Rockhampton 149,567 ounces, Croydon 63,114 ounces, Gympie 58,887 ounces, Etheridge 31,384 ounces, Ravenswood 13,424 ounces, Eidsvold 10,713 ounces, Palmer 10,719 ounces, Gladstone 6,504 ounces, Clermont 3,549 ounces, and Gayndah 4,451 ounces.

Charters Towers, Queensland's best gold field, yielded dividends in excess of a quarter of a million pounds sterling during the year 1891. The developments on this field have been remarkably good, the deep workings below 1,000 feet giving good pay ground.

Some interesting statistics of the cost of producing copper in the Lake Superior, Montana and Arizona mining districts, during 1889, are given in the United States Census Bulletin (No. 96). The results are tabulated as follows:

Copper Produced.	Cost of Mining.		Cost of Concentrating and Smelting.		Total cost per lb. Copper.*
	Total.	Per lb. of Copper.	Total.	Per lb. of Copper.	
	$	Cts.	$	Cts.	Cts.
Michigan :—					
87,455,675...	7,478,828	8.55	985,595	1.25	9.8
Montana :—					
97,868,064...	3,204,415	3.27	6,297,538	6.43	9.7
Arizona :—					
31,362,685...	1,146,819	3.65	1,257,892	4.01	7.6

* In Michigan, mineral of 74·26 per cent.; in Montana, matte and Bessemerised bars; and in Arizona, bars and matte.

A recent official report states that the gold mining industry in Dutch Guiana is steadily increasing. A slight decline in production has occurred during the last two years, but this is to be attributed largely to placer owners building their hopes on companies and syndicates buying their land, and, in the meantime, ceasing the developments necessary to keep up the average returns. The auriferous belt extends throughout the three Guianas from Cayenne to Venezuela in an easterly and westerly direction, in width about 100 miles. The formation of the gold belt is metamorphic slates, schists and occasional dykes of sandstone and gneiss. Mining has been principally confined to alluvial washings, and very satisfactory results have been so far obtained. The amount of gold exported increased from 475,953 grammes in 1879 to 1,029,777 grammes in 1888. Last year the export amounted to 987,218 grammes. The government has done nothing to open up the country by the construction of roads, or making the river more navigable for small steamers, to advance the mining interests of the colony. It is only during the past two years that any attention has been given to quartz mining, and the developments during this time have produced highly satisfactory results.

The question of blasting in fire damp mines has been solved, so far as the Prussian mines are concerned, says the Berlin correspondent of a contemporary, by simple prohibition at all points at which accumulations of fire damp are indicated by the safety lamp. This prohibition extends to all underground workings in close draught connection with points not free from fire damp. Blasting with black powder or other slow explosives is also forbidden in underground workings in which inflammable coal dust is known to form. In all cases it must be determined before blasting that there are no accumulations of fire damp within eleven yards. This solution of the question meets with general approval among experts. It is regarded, however, as expedient that blasting with black powder, or similar slow explosives, and with gelatinised nitro-glycerine and the like, without

special safety cartridges, should be entirely prohibited at points with an outflow of fire damp, coal dust, etc., as recent experience has shown that dry coal dust involves danger of combustion, and that even the last mentioned explosives afford no adequate security, even in the absence of fire damp. It is also demanded that blasting at such points should be permitted only to experts certificated by the official Board of Mines.

Mr. A. P. Lacey, a Duluth contractor, believes he has solved the question of the prevention of coal dock fires by the invention of a system of ventilation by condensed air pressure. Pipes for conveying the air will be laid along the bottom of the dock with openings every few feet. An air pump will supply fresh air to the coal and thus prevent the accumulation of gases and heat which originate spontaneous combustion. In connection with the system will be built a large tank for the storage of soda gas, the same as used in chemical engines, and in case a fire should break out this gas can be forced through the pipes and at once reach the seat of the fire.

It will be remembered that soon after roburite was placed on the market some complaints were made by the colliers in the North of England, of the unhealthy nature of its fumes. A joint committee, representing the Durham Coal Owners' Association and the Durham Miners' Association, was appointed to investigate the matter, and their report has been made public. The most important point decided by the professional gentlemen engaged in the investigation is that the products of the explosion of roburite and tonite are not more deleterious than the products of the explosion of gunpowder. As both roburite and tonite are safer and more powerful explosives than gunpowder, their use, now that their true nature has been fully disclosed, ought to be largely extended. With regard to the effect of the explosion of roburite, no chemical evidence was obtained of the presence of nitrobenzene, and throughout the enquiry no case of nitrobenzene poisoning was met with. The elucidation of these two important facts ought to dispose of any objections workmen may still have to the employment of roburite and tonite, and the same remark applies to the presence of carbon monoxide. It is stated by the experts that, with regard to the production from roburite, tonite, or gunpowder of the monoxide, the quantity found in average samples of air collected in the place is small, and is so quickly dissipated by the air current as to have been detected only in traces at an interval of five minutes after the firing of the shots. The investigators, therefore, having regard to the rapid and progressive dissipation of the fumes by the air current, base a strong recommendation upon this fact, namely, that an interval of at least five minutes be allowed to elapse after the firing of the shot before the hewers re-enter the place where the shot has been fired. An equally urgent recommendation is added to the effect that, as part of the gases detected in the fumes are produced by the burning of the fuse, cartridges should be fired by electricity.

The use of natural gas as a fuel in rolling mills and steel works has greatly decreased within the last two years. The record of the works using this fuel in the manufacture of iron and steel was 6 in 1884, 68 in 1886, 96 in 1887, 104 in 1889, while in Jan., 1892, only 74 were using natural gas in whole or part. Of the works still using this fuel 45 are in Pittsburg and Allegheny Co. and 11 elsewhere in Western Pennsylvania. Of the others, one is in West Virginia, 11 in Ohio and 6 in Indiana. Two years ago there were 60 works so run in Pittsburg and Allegheny Co. This decline in use is due to a shrinkage in the supply, and the manufacturers have either returned to the use of bituminous coal or use producer gas made from coal.

Statistics of boiler explosions in 1891, compiled by the Hartford *Locomotive*, report that of a total of 257 explosions, 68 were in saw-mills and other wood working establishments, 35 were of portable boilers, 22 of locomotives, 23 at mines and oil wells, 17 on steam vessels and 16 at rolling mills, the others being variously distributed; 263 lives were lost, the lowest number in five years; 371 persons were injured as against 351 in 1890, 433 in 1889, 505 in 1888, 388 in 1887, and 314 in 1886. A summary of the work done by the inspectors of the Hartford Steam Boiler Inspection and Insurance Company shows that 137,741 boilers were examined in 71,227 visits of inspection. Total number of defects, 127,609. In 526 cases the defects were found so dangerous that the boilers were condemned. Of the 10,858 dangerous defects found, leakage around tubes was the most common, 2,877 cases of that nature being reported. Defective rivets came next, with a total of 1,097; and the most dangerous classes are incrustation and scale, 676; and fractured plates, 672.

A directory of the iron and steel works in the United States for 1891, just published, contains much matter of value with reference to these important industries. The aggregate capacity of the 539 blast furnaces, enumerated as being in operation during that period is placed by the owners at 16,296,793 tons net, or an aggregate weekly capacity of 313,400 net tons, and a weekly average of 551 tons for each furnace. In November, 1887, the weekly average per furnace was 363 tons, and in November, 1889, it was 440 tons. The remarkable growth in the last four years can be better expressed as follows in aggregate capacity:—

	Net tons.
Nov., 1887, 582 furnaces.....	10,990,993
Nov., 1889, 575 do	13,168,233
Jan., 1892, 569 do	16,296,793

The abolition of the old-style small coal cars has been decided on by the Reading and Jersey Central Railway. The little cars have been the cause of many destructive and expensive wrecks. They are so light that when a train's speed is too suddenly checked they "hump" in the middle of the train with disastrous results. Large investments are to be made in new rolling stock to replace the old. Already nearly 2,000 large gondola cars have been ordered for the coal traffic, besides many other heavy box cars. Two hundred and fifty of the box cars will have a carriage capacity of 50,000 pounds apiece. The new equipment will have automatic couplers, and the box cars will be provided with air brakes.

The Government Geologist for Queensland has issued a very favourable report with regard to the coal discoveries in that colony, in the course of which he describes the find as the most remarkable ever made in Australia, and estimates the total amount of fuel in the field at 50,000,000 tons. "Last year," he adds, "the output of coal for the whole colony was 338,344 tons, the largest output of any year; so that over the area already proved only, there is sufficient coal to last 150 years, with an output equal to that of the whole colony last year. There is not the slightest doubt, however, that the coal exists over a much larger area." It is expected that steps will be taken to place the field in direct communication by railway with Gladstone, which in some quarters is estimated as the best deep water port on the eastern coast of Queensland. About 60 miles of the line will have to be constructed at a cost of £200 per mile. No information is given as to the quality of the newly discovered coal, and in the absence of that it is difficult to form even an estimate of the real value of the new field.

CORRESPONDENCE.

The Geological Survey's New Map of Nova Scotia.

SIR,—The characteristic inconsistency of Dr. Selwyn, the Director of the Geological Survey Department, in not considering the branch of economic geology in Nova Scotia as that of the first importance to the various mining districts, is too well illustrated in his having the maps plotted and published on a microscopic scale. Economic geology is to the various mining districts in Nova Scotia, or any other province, that of the first importance when it is made with scientific exactness in the construction of the plans which are necessary to aid in recording the details, both scientific and economic. Scientific exactness and economic usefulness cannot be secured on a microscopic scale, for these maps must be on a scale so that "he who runs may read, and who so reads may understand." In other mining sections, such as North Hastings iron and gold district, and in the Lievres phosphate district, he has yielded to the demand that the scale is to be forty chains (one-half mile) to one inch. The necessities of the mining industry of Nova Scotia demand plans or maps on an equally clear and comprehensive scale for the various mining sections of this Province.

MINE OWNER.

MONTREAL, Que., 2nd March, 1892.

Sudbury Nickel Deposits.

SIR,—In the June number of your valuable journal I read with much interest the able and comprehensive paper of Alfred Barlow, M.A.—perhaps the most complete description of our mining enterprises yet offered to the public. It is impossible for a stranger to be perfectly certain of all the statements collected by him, and I trust he will excuse a few trifling corrections and additions by an early prospector.

Wallace Mine.—He stated that no true vein has been found at the Wallace mine; and the same statement occurs in the report of the Ontario Mining Commission. The true lode *was found under* the stringers mentioned by Murray, and I can show it for a distance of above two miles W. by S. from the shafts. A parallel vein runs south of it, with a fair show of nickel, changing to iron as it goes westward. They are separated by a mass of hornblende, which frequently overlies the more northerly vein. One mile north there is a very fine vein of hematite, which runs into nickel ore as it goes eastward from the iron.

Waters.—I located the deposit of nickel north-west of Waters in July, 1885, for McAllister. It differs slightly from the Sudbury deposits. I took samples from the Murray when the rock-cut began—November, 1883—and made the first assay in Sudbury, by dissolving natural sulphates, and proved the presence of copper by immers-

ng an axe in the solution. I located the hills north-west of the Stobie 11th May, 1884, and the *Lady Macdonald* n November following. I believe that there are a number of mineral bands crossing Algoma from N.E. by E. to S.W. by W., and maintaining great regularity of direction hrough long distances.

American capital seems to be the chief factor of progress yet: but Ontario may possibly awaken to the wealth of her heritage before it is all in foreign hands.

T. FROOD.

WALLACE MINES, 27th Feb., 1892.

The Coal Royalty in Nova Scotia.

For some time past there have been rumours that the Local Legislature would increase the royalty on coal from 7½ cents on "round" coal now paid to the Government to ten cents per ton on the "run of mine" product. Matters took a practical turn on the 16th inst. when a number of the leading operators, with representatives of the other mineral industries, met in Halifax and made preliminary arrangements for the organization of a united association. A deputation also waited upon the Executive Council of the Legislative Assembly and submitted a statement covering the objections taken to any further impost on the present rate paid. The memorial was as follows:—

"That the Government has issued three classes of coal leases:—

"First:—Those in accordance with original terms and with section 102 of chapter IX of the fourth series of Statutes.

"Second:—Extended original leases with renewals nominally, in accordance with section 105, chapter VII of the Fifth Series.

"Third:—New leases with modifications authorized by Legislation of 1886 and subsequently.

"That in the case of the last no question of 'right' is raised when it is proposed to increase the rate of royalty.

"The holders thereof pray for clemency, and a careful consideration of the returns they receive for the outlay they may incur.

"In the case of the second class the holders contend they accepted the Form of Renewal offered by the Department of Mines in 1886 without investigation, naturally assuming that their full rights would be respected by the Crown officers, and that they were unaware that other lessees were receiving Forms of Renewal more in accordance with their original leases, and they have reason to believe that the forms given to and accepted in ignorance by them, were drafted without the knowledge of the Government or the opinion of the Attorney General of the day.

"The holders of the first class contend that the proposal to increase their rate of royalty touches the SANCTITY OF CONTRACTS, that besides retaining their original leases the renewals they hold are not new leases to be affected by the Legislation of 1886 and subsequently, with one exception.

"The original leases read that they were renewable 'on the same terms, conditions and covenants as are contained therein'—with one exception which the legislation could alter in or after 1886. That the Department of Mines has acknowledged that the lessees complied with the conditions, etc., required, and were entitled to a renewal on the same terms, conditions and covenants as in the original lease.

"The contention hence is that the leases they hold are extended or renewed leases, not new leases.

"Further, that the whole spirit of a lease is to secure to the lessee, on complying with certain conditions, a title good for a specific terms of years on payment of a maximum rental or royalty: that a document reserving to the landlord the right to increase at will such payments would place him in the position merely of a 'tenant at will,' a position wholly incompatible with the expenditure a proper working of a coal mine in this country entails.

"And this contention the lessees are ready to leave for trial in the Courts of Justice. (Not agreed to).

"Holding this contention they are advised that the Legislature did act on their right reserved in the clause of the lease "Provided that the Legislature may revise and alter the royalty imposed by these presents in or after 1886 as they may think fit when they amended the Act in 1885 and applied it to the renewals of 1886.

"Having then altered the royalty in 1886, their right to alter the royalty after 1886 may be exercised in good faith with the lessee prior to each of the subsequent renewals contemplated in the original lease, the next being in 1906: but not during the current period of any term of renewal as now proposed by the Government.

"Further, that the late introduction of clauses into the Mines and Minerals Act reserving to the Legislature the power to increase at will the rate of royalty defined in future leases is arbitrary, unfair and inexpedient, and is contrary to the true spirit of a lease made in the sacred name of Her Majesty the Queen: But that it also implies that the power (with justice) of the Legislature did not allow of such a contention being held prior to the passage of the amendments to the Act.

"Lessees have contended that if the rate of royalty can be and is increased without a breach of faith on the part of the Legislature they will be at the mercy of the increased necessities of the country entirely disproportionate to the extension of their industry and the returns they receive for their hazardous business. In reply they have been told by the Government they are willing to fix a maximum rate if the lessees agree, to which the counter reply has been made:—The leases now held on renewals state a maximum rate for the current period of renewal, and to allow the justice of the proposed increase would be to acknowledge that the power of the Legislature had been used to override previous legislation on the faith of which large expenditures had been made and the good name of Nova Scotia was pledged: and that if so used there was no guarantee that the maximum now (if) placed would be respected but that the same power might be subsequently exercised to again override this new maximum rate.

"The lessees wish it to be clearly understood that in these contentions they regard the Government as a landlord of mineral rights entirely distrinct from the Legislature with power to tax any industry, to repudiate contracts, and confiscate property without indemnity.

"They exceedingly regret that necessity has forced them to refer to this power, and they have done so only because it has been impressed upon them by the Government of the day that this power lay with the Legislature, as it lay with the Local Government of Prince Edward Island to confiscate without indemnity the lands of absentee landlords (bills disallowed) and with the Quebec Government to modify the rate of interest on debentures (bill withdrawn.)

"The body of the lease [omitting unnecessary legal phraseology] reads as follows:—The company, their successors, shall be entitled to a renewal thereof, for such extended term, upon the same terms, conditions and covenants as are contained in these presents provided the company are and shall continue to be bona fide working the area and complying with the terms, covenants and stipulations herein, and provided also that the Legislature shall be at liberty to revise and alter the royalty imposed by these presents in or after the year 1886 as they may think fit. Yielding the rent or royalty of six pence, Halifax currency, for every ton of coal of 2240 pounds except coal now known in the Province as slack coal and except coal to be used by the workmen of the company or to be used in carrying on their operations which shall be wrought and sold or otherwise used and consumed.

"And that the said company shall keep one or more books of account wherein true entries shall be made of all such coal as shall from time to time be wrought or gotten forth and sold or otherwise used and consumed by the said company, distisguishing in such accounts large coal from the said slack coal: and in case the entries do not so distinguish the large coal from the slack coal the whole quantity, so far as applicable to the payments of the said royalties hereby reserved are concerned, shall be considered as large coal.

"The Mining Association asks to have sub-section (e) of section 105 of chapter 7 of the revised Statutes retained. It reads:—'In the cases of leases that are eligible for renewal in which the conditions of renewal embodied therein are different from those prescribed by this chapter, and the lessees thereof are unwilling to have such conditions altered, the commissioner shall have power to renew said leases on the terms contained therein, and as prescribed by chapter 9, Revised Statutes Fourth Series, and no other.

"They also request to have added to section 113 of the present revision the words 'prior to each period of renewal.'

"To have the words 'or of any Act heretofore passed' of section 116 struck out.

"Also section 122 omitted.

"It was also contended:—It is one of the conditions of the lease that 'slack' coal separated from lump coal shall be exempt from payment of royalty..

"Hence that the landlord is not justified in making the rate of royalty exclusively on run-of-mine coal except with the consent of the lessee."

The Provincial Mining Association of Ontario—Outcome of a Convention Held at Sault Ste. Marie.

A convention of parties interested in the development of the mining industry in Ontario, was held on 31st at Sault Ste. Marie. The following were appointed officers provisionally:—

President—James Conmee, M.P.P.
First vice-president—James Stobie.
Second vice-president—Capt. J. S. Skews.
Secretary—John McKay.
Treasurer—Duncan Bole.

Directors—*Rat Portage:* Messrs. Young, Savage, Lyon, Brydon; *Port Arthur:* Messrs. McMillan, G. H. MacDonnell, M.P., D. F. Burke, T. Marks, J. L. O'Connor, S. Lutz, James B. Miller, A. J. Duncan, Joseph Cozens, F. Rogers and M. McFadden; *Bruce Mines:* John Nicholas, John Knight, Thomas Sullivan, Samuel A. Marks and David Jackson; *Thessalon:* W. J. McKinley, Frank Marks, M. McLeod, James B. Dobie; *Sudbury:* W. B. Hammond, James A. Orr, F. L. Sperry, R. McConnell, W. J. Skynner; *Toronto:* Arthur Harvey, W. Hamilton Merritt, John Taylor, E. F. Morris and H. W. Darling.

Resolutions Adopted.

The following resolutions were passed:—

"(1) That royalties on mineral being a most pernicious tax on labor and capital, the terror of all mining capitalists and the great cause of our present dulness in mining interests, this convention in the most emphatic manner pronounces against all royalties on minerals.

"(2) That the local Crown land agent's office should be the only office at which applications for mining lands can be made, and the duty of such officer should be to receive and number consecutively all applications for free grant and mining lands within his jurisdiction and keep the same for public inspection. To facilitate such inspection he should keep in his office, in a conspicuous place, easy of access, a list showing the number of each application, the date upon which it was fyled, as well as the date of the discovery to which it relates and the date of the expiration of the same under any regulations relating thereto, together with the name of the applicant or applicants and their address, and having a reference by number to a description of the land so applied for on a map or place, which he should also keep, showing the area covered by each application, which plan should also show a land patented and the date of the issue of the patent and the name and address of the patentee..

For the Settler Only.

"(3) This convention expresses its delight to notice that the Patrons of Industry of Ontario declare almost unanimously in favor of reserving the public lands for the actual settler, and hereby most emphatically recommend that all lands be open for all persons of the age of eighteen years to locate to the extent of 160 acres only each, and who takes possession within three months from date of application and upon residing thereon for three years, clearing and cultivating ten acres, building a house 60x20 or upon spending $300 in mining development, shall be entitled to obtain a patent therefor without any reservation of either pine or mineral, and which he may at any time before issue of the patent elect to purchase same at the usual price of mining land and obtain patent at any time with the usual reservations and shall retain his homestead right.

"(4) That we would strongly urge that the price of all mineral lands in the Province should be the same, and that $2 per acre is an ample price therefor, and should be payable $1 cash and balance on or before one year from date of application.

"(5) That the unwritten custom known as or called the "Blanket application" regulation we condemn and pray that it be abolished.

"(6) We recommend that the Crown land agents be paid partly by salary, with the privilege of charging the locatee and the purchaser a reasonable price for each lot located or sold, to be fixed by Government.

Public Highways, School of Mines, Etc.

"(7) That liberal land or money grants similar to those made by the Dominion Government should be made for the building not only of highways, but railways throughout unsettled portions of the Province. There are millions of acres of Provincial lands which are wholly inaccessible by any other than a canoe route and cannot be mined without roads. The judicious and liberal expenditure of money in roads, and in some cases, where experience has proved the value of the district, in railways, would tend not only to promote the actual mining, but the additional sales caused by such expenditures would more than reimburse the Province for its outlay, besides adding largely to its population and wealth.

"(8) That a school of mines should be established at some central mining point in the district, where a practical knowledge of mining, smelting and refining ores may be obtained.

"(9) That the price of mining lands belonging to the Department of Indian Affairs be reduced to $2 per acre.

"(10) That we trust the Dominion Government will not place an export duty on nickel, as we believe the effect would be disastrous.

"(11) That this Mining Convention is delighted to see the good and large display of roots, cattle, grains and agricultural products generally, of all kinds, raised by farmers residing within the district of Algoma and exhibited at the fall show of the Eastern Algoma Agricultural Society, now being held at Sault Ste. Marie. The exhibits we have seen at this show prove conclusively that Eastern Algoma possesses the greatest possible agricultural resources and we trust that every effort will be made to let the world know something about the good agricultural resources which exist in Algoma.

"(12) That the Ontario Government be requested to appropriate a sufficient sum of money to make a suitable display of the vast and rich minerals of Ontario at the Chicago World's Fair."

The Province of Algoma.

The following resolution was moved and seconded, and after full discussion was deferred until the next meeting of the association:—

"That this convention would respectfully petition the Parliament of Canada and the members of the Legislative Assembly of Ontario to enact necessary legislation to create that portion of the Dominion of Canada and Province of Ontario which is bounded on the south side by the State of Minnesota, by Lakes Superior and Huron and the French River, on the east by the Province of Quebec, on the north by the James and Hudson Bays, on the west by the Severn and Wastickwa Rivers and the Province of Manitoba, containing about 275,000 square miles, into the Province of Algoma, believing that it is principally a mineral and timber country and the wealthiest portion of Canada in natural resources, and that in a few years Algoma would be the banner Province of this grand Dominion of ours, and would be to the general benefit of Canada."

Ontario Mining Policy.—Resolutions Submitted to the Government by the Sault Ste. Marie Board of Trade.

We would humbly and respectfully submit to the most serious consideration of the Legislative Assembly of Ontario the resolutions contained in the Sault *Express* of April 18th, 1891, and the resolutions unanimously passed by the Provincial Mining Association of Ontario in October, 1891.

We would further humbly submit :—

"That the mines of the United States pay a larger percentage on the capital invested in them than was received from any other class of industrial undertakings in that country during 1891 ; and that they have never been operated at so great a profit as during the said year, the value of the output of same being estimated at $1,000,000,000, being fifty times that of the output in Canada.

"That while Minnesota imposes a royalty on mineral contained in her State lands, yet the United States owns thousands of square miles in the said State fully as rich in mineral as the said lands belonging to the said State, and that they are having same surveyed and otherwise preparing to open this vast tract which contains, it is estimated, about $250,000,000 worth of pine besides other valuable timber.

"That the actual settlers will be able to obtain a patent to 160 acres containing pine of the value of from $1,000 to $10,000 and in some cases containing mineral of greater value by residing thereon fourteen months and performing certain settlement duties and paying an entry fee of $10.

"That the said United States Government lately opened for settlement a similar tract of land near Ashland, Wisconsin, of 150 square miles, containing $2,000,000 of pine and the same was located in a few hours by actual settlers among whom there were not a few Canadians.

"That the depression in prospecting and the mining industry industry in Ontario was caused by the imposition of a royalty on mineral and other detrimental legislation.

"That Algoma is somewhat similar to Minnesota, principally rich in mineral and timber until the same becomes somewhat settled and then the agricultural lands become valuable.

"That the poor man at present is absolutely and almost hopelessly debarred from obtaining any interest in pine or mineral lands in Ontario and is driven to the United States to obtain such an opportunity as above mentioned.

"That we fear an extensive exodus will take place from Ontario to Northern Minnesota unless equally liberal homestead laws are enacted respecting Crown lands in Ontario.

"That if all the pine and mineral in the alternate townships were reserved for the actual settler, who, upon residing three or five years on 160 acres and clearing and cultivating fifteen to thirty acres and upon paying an entry fee of $10, should be entitled to a patent thereof with all the pine and mineral thereon.

"That to encourage the construction of colonization railways northward to Hudson Bay the other townships with all the pine and mineral should be given to such railway companies to the extent of 12,800 acres per mile (which is the area granted to the Winnipeg and Hudson Bay Railways in the North-West Territories.)

"That the grants to both the actual settler and railway company shall be subject to timber dues of $1 per thousand on all pine, payable as the same is cut.

"That under such a law there would be from $50,000,000 to $100,000,000 paid into the treasury of Ontario in respect of timber dues, which would be sufficient to keep the Province from direct taxation for about seventy-five years.

"That Ontario laws, we are convinced, offer less inducement to the explorer or actual settler than any other civilized or semi-barbarous nation in North or South America notwithstanding the boundless extent of Canada.

"That Algoma is the richest portion of Canada in natural resources and if given to the actual settler and colonization railway companies, as hereinbefore set forth, it would soon contain a populatien of 1,000,000 which would furnish a tremendous impetus to the prosperity of Old Ontario.

"That the development of the mining industry is as important to Canada as that of farming and more important than that of manufacturing, and we submit that mining legislation satisfactory to those interested in mining should be enacted.

"That the United States have reserved almost its entire public domain for the actual settler and have ceased to hold lands for speculation, and this course is not questioned by the electors for that country.

"That while the honorable opposition members were unanimous previous to the general election to give the pine as well as the mineral to the settler, yet after the election was over no effort was made to secure such legislation, but on the contrary, at the first opportunity, deprived the actual settler of the mineral as well as the pine.

"Wherefore we would humbly and respectfully petition the Honorable Legislative Assembly of Ontario to enact laws in accordance with the foregoing suggestions.

"THE SAULT STE. MARIE BOARD OF TRADE,
"(Signed) W. H. PLUMMER, President.
"(Signed) JOHN MCKAY, Secretary."

Dated March 3rd, 1892.

The Nickel Deposits of Algoma.*

BY JAS. B. HAMMOND, SUDBURY.

It would be safe to say that since the first discovery of the veins and massive deposits of phosphate in Ontario and a few years later in Quebec, described by the late Dr. T. Sterry Hunt as early as 1848 in reports of the Canadian Geological Survey, no discovery in the mineral field in Canada has attracted more general attention, or assumed greater importance in the arts than that of the newly found deposits of nickel ore in the districts of Nipissing and Algoma. There are, however, aside from its attractiveness commercially, many features of more than passing geological and mineralogical interest in connection with this subject which claim our more immediate attention. To these let us turn first and principally :

Confining ourselves within the limits at our disposal in this paper more particularly to the geological conditions of the nickel deposits themselves, we shall merely observe in passing that as regards the general geology of these districts, we have to do principally with rocks of the Laurentian and Huronian formations, and with certain dark argillaceous sandstones and silicious volcanic breccia of possibly earlier origin. The rocks of the Laurentian series most frequently met with consist of gneisses and hornblende-granite, while in the Huronian series occur quartzites, greywackes, felzites, quartz-diorites and clay slates. The country shows unmistakable signs of denudation and is abundantly watered by rivers, small streams and innumerable lakes forming a network over the face of it.

Since the year 1882, when copper ore was unearthed in an open cut, about four miles north west of where now stands the town of Sudbury, during the construction of the Canadian Pacific railway, and where now, upon the later discovery of nickel-bearing ore, H. H. Vivian & Co. have recently erected smelters for its reduction, up to the present year, 1892, the discoveries of such ore have been of almost monthly occurrence, and hardly a year has passed without adding its quota to the more important "finds" made. We are thus indebted in the first instance to the prospector for empirical knowledge upon our subject, and to the chemist for discovering its possible economical importance.

Passing to the geologic and lithologic conditions under which our nickel deposits occur, it is interesting to note that we have to do, in almost every instance, with very similar modes in this respect. Upon the lines of contact between the Laurentian and Huronian formations, or within the latter formation itself, there occur more or less lenticular and elongated formations (extending often for many miles) of a crystalline igneous rock composed of a triclinic felspar and hornblende of numerous varieties, known as diorite, upon whose line of contact in turn, or in the body of this rock itself, a nickeliferous pyrrhotite of varying richness and massive nature outcrops, and assumes the form of lenticular masses (more rarely in more or less well defined veins) and frequently associated and intermixed with chalcopyrite. Dykes of crystalline diabase intersect the Huronian rocks at irregular intervals and are often found in the neighborhood of such deposits.

It is worthy of remark that this nickel-bearing rock is often more or less densely impregnated with mineral without forming more than a small fraction of its bulk, a fact which seems to indicate that some process of cooling had taken place before these mineral particles had run together, as in the formation of a "pocket" of ore.

Quartz veins are also of frequent occurrence in the rocks of the district and an associate in the deposits under consideration. The veins or masses of quartz, it may be added here, are frequently found to carry gold, and traces of silver, especially in cases where the quartz predominates in such mixtures of rock and ore. It is also characteristic of these deposits that they may often be recognized by the reddish or yellowish deposits of earth and weathered ore upon the surface, a process of desintegration hastened by forest fires; while in the green bush certain moss-covered air-holes and a noticeable sagging of certain portions of the surrounding surface due to oxidation, most frequently where much copper is present, but it must also be noted that a second and equally valuable class of deposits, especially as regards quantity, carries very much less copper and that these signs fail to appear. On the contrary, you have "struck it" by mere accident upon breaking off a piece of the ringing ore with the pick or hammer. The yellowish "gossan" above mentioned, and the ore in the vicinity, not infrequently run high in platinum in the form of the new mineral discovery by F. L. Sperry and named after him "Sperrylite." This mineral is successfully mined in the district. The writer has washed out a pan that ran 75 ounces to the ton of platinum. Other nickel ores occur in the district as nickelite, gersdorfite, and millerite, but have not yet been developed to any great extent.

It will be seen from the above that the direction of the contact of the different formations governs that of the deposit, and is generally in a north-easterly and south-westerly direction, Such "leads" may often be followed for miles across the country outcropping at irregular intervals quite definitely, and yield best in lowest ground. These "leads" run more or less parallel to each other, following the "diorite." Their width is subject to great irregularity, varying from a foot or so to a hundred or even more in exceptional cases upon the surface. The experience already gained in mining here justifies the opinion held by many that these lenticular ore bodies increase or diminish in width as we descend, conformably to the contact in a general way, and that similar shaped ore bodies occur again at greater depths and of varying size and richness. As regards this latter characteristics we find upon the whole that the ore increases in some cases very markedly in richness as depth is reached.

Of the nature of the nickellifferous ore itself it has been doubted whether the nickel occurred as sulphide in the pyrrhotite or in a free state finely disseminated through its mass, but it is present in any specimen of the ore in varying quantities and runs from 1 per cent. to 6, 8 and 10 per cent. and sometimes exceeds even this. The average for the district is in the neighborhood of 3 per cent. in nickel and about the same in copper, and is thus low grade. The class of ore is often indicated by that of the accompanying rock. The finer grained varieties of medium hardness being looked upon with favor, hut boulders of various descriptions of rock, such as quartz-syenites, quartzites, greywacke or crystalline schists together with various species of diorite are often found imbedded in the ore body.

Less frequently the deposit exhibits a well defined foot wall only, and takes on the semi-nature of a vein. At other times the deposit is a confused mass of rock and ore, while again we meet thousands of tons of solid ore in sight, but in no case has a deposit yet been entirely exhausted, and the supply may thus be said to be practically unlimited. The Canada Copper Co. at an approximate depth of 700 feet. is stoping large quantities of ore daily. This compony has been smelting steadily since the latter part of the year 1888, and has recently still further enlarged its plant.

While it may be said of our nickel deposits that there is no doubt that many discoveries will yet be made on the lines above indicated, upon the further discovery of belts of diorite northwards and southwards as exploration and survey are pushed in these directions, it must be added that in a general way an erroneous notion prevails in certain quarters as to the absolutely unlimited extent of our nickel bearing rocks, and, in lieu of personal exploration a glance at the map lately issued by the department of the Geological Survey at Ottawa will convince the most sceptical. Again, it must not be forgotten that large tracts of the nickel bearing diorite already known disclose no trace of the mineral we have been considering.

I pass over the questions arising in the metallurgy of nickel, and consider for a moment, finally, the developmental and commercial aspect of the subject and its claims to our attention.

As regards the development already accomplished, we have to admit that United States enterprise and capital deserve the credit of having broken the ice for us. The Canada Copper Co., a misnomer as we are all now well aware, was the first to discover the invaluable resources of our nickel mines. It is largely due to Dr. Ed. Peters, jr., who laid the foundation of accurate and economic metallurgical knowledge in the schools of Germany, that he found here a fitting field for the exercise of his unquestionable ability in the metallurgy of nickel and copper, and he may look back with pardonable pride upon his success. His system of treating our nickel ores in improved water jacketed cupolas has stood the test of the successful handling of these ores in a wholesale way, and in making way for further efforts in the concentration of such products, as lately introduced by the same company. The Dominion Mineral Co., an essentially home institution, soon followed with great success, practically upon the same lines, under the management of Messrs. Atwood and Ferguson. This company, in the short space of a few months, put into active operation a smelter upon their property in Blezard township, a few miles north of Sudbury, and has lately suspended operations to make way for others upon a larger scale.

H. H. Vivian & Co., of Swansea, Wales, whose property lies about three and a half miles north-west of Sudbury, have also succeeded in treating our low grade ores upon English principles, and have a large and efficient plant, at present operated under the management of Messrs. Henricksen and Edwards. This plant was constructed under the management of Messrs. Merry & Merry, (father and son), well-known smelters of Swansea.

The last companies named commenced operations about two years ago. During the last season a fourth venture has made rapid progress, some 25 or 30 miles from Sudbury, in Drury township, where development upon the Travers or Inez mine is being pushed rapidly with the best prospects of success. The machinery will soon be all in place, and three large roast beds of ore are ready for the smelter. A fifth enterprise upon a property situated about thirty miles from Sudbury in the township of Lorne, and controlled by Chicago and Sudbury parties, has recently commenced operations, of which we will doubtless hear more in the near future. Lying over the nickel bearing portions of these districts are situated dozens of first-class properties which are as yet but little known and almost entirely undeveloped, but from many of which we will yet obtain most important results. Even a superficial examination of many of these will convince any expert, that we have here, by the simple but generous gift of nature, a treasure-trove of priceless value.

In any discussion of the best means of further developing these resources, from what has been already stated it may be easily gathered that we have in our power the choice of appealing either to home or foreign capital, or to both. The advantages to be derived are, however, quite different in their character and effects. An army of non-resident stockholders necessarily abstract from home circulation a vast amount of money in successful enterprises, while on the other hand we have to contend at present with an investing public to whom the legitimate claims

*Paper read by J. M. Clarke before the Canadian Institute, 25th Feb., 1891.

for investment in this field are but little known, and the effects of such investment still less. We are, necessarily, a young and comparatively inexperienced country in such ventures, but little acquainted with these as a people. The day is, however, not far distant when such shall have ceased to be the case, and when an era of speculation will have given place to the more solid and substantial utilization of our natural mineral resources.

The principal difficulty so far met with lies in the nature of the circumstances of the case. New and valuable discoveries in the mineral field we all know excite wide-spread influence in the mere hope of acquisition, but the capital, so expended aside from a small and insignificent portion speedily regained in lucky speculation, is but small in comparison with that required to win a lasting profit ultimately from the bowels of the earth, and many enter without full knowledge of all these facts, and fail, therefore, to grasp their full significance.

The chief idea in the acquisition of individual and national wealth in a country, apart from its commercial relations with other countries, lies in a just and reciprocal exploitation of its natural resources, and in their mutual dependence upon each other. The miner must have food and raiment, and the farmer must have the best means of cultivating the soil and a market for his produce. And right here it will be in place to emphasise the fact that no industry is more likely to assist the farmer, in the long run, in giving him a home market for his produce, than a home industry in successful competition with the outside world which secures to him in return its products as he needs them. A single mining company, it must be stated, has a monthly pay roll in these districts of from ten to twenty thousand dollars when mining its own ore, and this implies no mean consumption of farm produce.

It is impossible to say what the exact production of nickel in Canada has been up to this date, but an idea may be formed by giving the statistics or 1890 as quoted by John Stewart in a valuable article in the *Engineering and Mining Journal* of January 2nd last. In that year the product was 1,336,627 lbs. valued at $1,002,470. Since that time we had a large increase in the production of nickel and copper matte.

The question of the hour, now that a reliable source of these valuable metals has been discovered, is that of their most economic refinement. Edison's success in refining copper cheaply by electric methods has aided in increasing a feeling favorable to the extension of these methods to the refinement of other metals, including nickel, although in the case of this metal it is claimed that its oxide is more suitable for the well-known alloy it forms with steel. In a country like ours, abounding in valuable water power, a bright future would thus be opened to us in their utilization metallurgically, nor shall we have reached our highest development until nickel aud copper are separated and refined at home.

An effort is at present being made in these districts in the establishment of a custom's smelter, to develop still further their resources in the nickel field, and is meeting with the success it so well deserves from every quarter. It is in the development of natural resources alone that the hope of our young country lies, and any policy which has anything short of this in view must be pronounced at once short sighted and injurious. We have the privilege of rising to a proper consciousnes of our natural advantages, and of seizing upon every opportunity of legitimately developing them, or the dire alternative of suffering others, outsiders, to continue to reap what we should. As Canadians we have been intrusted with nursing into life and activity important interests ; with us rests the solution of the problem, and no where is our mission of more lasting importance to the general welfare of the country at large than in the mineral field.

Discussion.

After Mr. Hammond's paper was read the President invited discussion.

MR. J. RIDOUT said he would like to have further information as to the methods of refining nickel and as to the percentage of nickel in ore required in order to make its working commercially profitable. He thought steps ought to be taken to secure the establishment of a refinery in this country.

MR. GEO. MICKLE, M.E., stated that ore carrying 1% of nickel would, under favorable conditions, pay well. In his opinion the nickel in the Sudbury district existed in the form of a sulphide. There were isolated instances of arsenites of nickel, but sulphides were the general rule. There were several methods of extracting nickel from the matte, but elcctrolysis was the most satisfactory method. In some instances gold and silver were found with the nickel, but their absence was the general rule. The nickel in the ore had taken the place of a corresponding quantity of iron. In many of the discussions on the subject the strong chemical affinity of nickel for sulphur had been overlooked. There was no such affinity between gold and sulphur and hence the scientific difficulties of explaining the presence of gold in mispickel.

MR. A. HARVEY doubted the theory of Dr. Bell as to the formation of nickel. He thought the better opinion was that the process of formation was aqueous, and not igneous. The late Dr. Sterry Hunt favored the aqueous theory. He called attention to the fact that the International Convention of Geologists had decided that the names "Huronian" and "Laurentian" should be eliminated from geological nomenclature.

MR. E. A. ALVINS stated that in making an analysis of magnetic ore from Algoma, he found considerable quantities of gold and silver and asked if the presence of gold and silver in magnetic ore was general.

MR. DEWAR had, in a number of instances, found both gold and silver. He disputed Mr. Mickle's statement as to the presence of arsenides. He had found arsenides to be of frequent occurrence.

Gold Quartz Reduction.*

BY A. H. CURTIS, B.A.

The author reviewed the principal crushing and pulverising machines employed in the reduction of gold quartz, considering that term to include all auriferous silicious rocks, from true quartz to conglomerates such as the "banket" of Witwatersrand. Many of the machines were equally applicable to the treatment of other ores. The manner in which gold occurred in veins and other deposits was described, and an outline of the principal mechanical processes of gold extraction was given. The author then proceeded to classify and describe the more important crushing and pulverising machines, and to indicate their respective merits and defects.

1. *Ore Crushers or Rock Breakers.*—These are used for the preliminary coarse-crushing of quartz, and were subdivided into :—(A) Machines on the reciprocating jaw principle, including the Blake and Dodge varieties ; and (B) gyratory crushers, as the Comet crusher, and the Gates rock and ore breaker. The machines of Blake and Dodge differed chiefly in the method of suspending the movable crushing jaw ; and the latter, being a comparatively fine-crusher, was more particularly suited for mills of moderate capacity. In the Gates and Comet crushers, a gyratory motion was imparted by an eccentric to a vertical spindle, on the upper part of which a breaking-head was mounted. Both jaw and gyratory crushers were serviceable machines, the defects of the former being of small importance in regard to their use as gold-quartz crushers.

2. *Crushing Rolls.*—These were considered under three heads :—(A) Cornish rolls, with lever-and-weight compression. (B) Improved Cornish rolls, with steel buffer-springs or india-rubber buffer-cushions, possessing many merits, but having smaller capacity and durability than jaw or gyratory crushers, which were, therefore, preferred for coarse-crushing. (C) Krom's rolls possessed great strength and durability, and were capable of much finer crushing than Cornish rolls. The author described this type at length, being of opinion that no more efficient dry-crusher had hitherto been produced. Dry-crushing, was, however, only recommended where water was not abundant, or where the subsequent concentration of the ore, and the separation of the gold were accomplished by dry methods.

3. *Stamps.*—These are fine pulverisers. The varieties described were :—(A) Gravitation stamps, which are lifted by rotating cams and fall by their own weight ; (B) special forms of stamps, including oscillating, pneumatic, steam, elephant, and other varieties. The merits and defects of gravitation stamps were discussed at considerable length. The principal merits consisted in the simplicity of construction and working ; while the great weight and certain features of their crushing action constituted serious defects. Within certain limits, and under certain conditions, stamps were efficient pulverisers. Unless the mortars had a sufficiently large discharge area, and the ore was very carefully fed into them, there was considerable risk of loss of gold, owing to the production of "slimes," as well as to overstamping of the precious metal contained in the gangue. As wet-crushers of extremely hard ores, gravitation stamps could not be excelled. Husband's and Sholl's pneumatic stamps, and the ordinary steam stamp, were, in the author's opinion, more adapted for medium than for very fine pulverising, owing to the difficulty attending the use of thin screens in mills of such large capacities. The elephant stamp, in which a certain saving of power was effected by the use of springs, was a useful prospecting plant. The author preferred Krom's rolls to stamps for dry-cruhing. The Huntington mill, which granulated instead of pounding the ore, was recommended in place of stamps for the wet-crushing of clayey, brittle, or soft quartzes.

4. *Roller and Edge Running Mills.*—Two varieties were considered :—(A) The Bryan roller quartz mill, in which three metal rollers revolve in a circular pan or mortar, the arrangement somewhat resembling the Chilian mill. Mercury was placed in the pan for amalgamation. The construction of the machine was faulty, and there was great wear and tear, as well as appreciable waste of power ; while with pyritic ores there was necessarily considerable sickening of mercury in the pan. (B) Huntington's centrifugal roller quartz mill. Three or four rollers, suspended from a rotating circular frame or disk-driver, were urged outwards by centrifugal force to a circular steel ring die, against which the ore was pulverised. Mercury, for amalgamation, was placed at the bottom of the mill, the rollers being so suspended as to pass freely over it, without coming in contact with it and stirring it up. Paxman's patent roller-head, an improvement on the older construction, was described. The mill was recommended by the author for clayey quartzes (which required a certain amount of puddling before the gold was liberated), for quartzes of medium hardness, and for grinding coarse tailings.

5. *Ball Pulverisers.*—In these machines, coarsely crushed ore, or coarse tailings, were pulverised by a ball, or balls, of chilled iron, steel, or other durable metal revolving on a circular track or path. This grinding path may be vertical or horizontal, preferably the latter. Several varieties were described. The principal objections to ball pulverisers as a class were the great wear and tear of grinding-surfaces, and the amount of power required to drive them. Their greatest utility was, in the author's opinion, as grinders of coarse tailings, or of ore already more or less finely comminuted.

6. *Pneumatic Pulverisers.*—Contrivances in which small fragments, or coarse particles, of ore are hurled against each other by the action of two opposing currents of air, or in some other manner, with such force as to cause them to be finely pulverised. The author described the principal machines of this kind, and pointed out that the high speed at which they generally required to be driven was a decided disadvantage, entailing an excessive amount of driving power.

7. *Miscellaneous Grinders or Pulverisers.*—Under this head were described :—(A) The Niagara mill, in which the ore was pulverised by a heavy edge-runner, contained in a metal drum rotating in a hollow horizontal axis, through which the ore was exhausted by a fan as soon as it was sufficiently finely comminuted. Where dry-crushing was advantageous, the author, for reasons specified, preferred Krom's rolls. (B) The Howland pulveriser, consisting of a circular pan in which the ore was granulated against a steel ring die by twelve disks or rolls, which lay on a horizontal carrier plate, rotated by bevel gearing. The rolls were urged outwards to the ring-die by centrifugal force, and rotated against it by friction. The action somewhat resembles that of the Huntington mill, which the author considered a more efficient machine.

8. *Grinding and Amalgamating Pans.*—These are used for grinding to minute particles ore already more or less finely reduced by other machines, and subjected to subsequent concentration ; and, secondly, to effect an amalgamation of the gold contained in the pulp with mercury introduced into the pan. The numerous varieties of grinding-pans were briefly referred to, but did not call for any special criticism.

In some general conclusions, the author indicated the particular classes of work for which the more important coarse-crushers and fine-pulverisers were severally adapted, and summarised their essential requirements. The author pointed out that prime cost was a secondary consideration in selecting reduction machinery. Weight, amount of power required for driving, cost of renewals, and simplicity or otherwise of construction, were economic considerations of great importance.

*Abstract of paper read before the Institution of Civil Engineers, February 2nd, 1892.

Sulphuric Acid From Iron Pyrites.

At Beaufort, S.C., and at Savannah, Ga., sulphuric acid has been made from iron pyrites, but the business commenced on a large scale in Georgia when the $50,000 plant of the Coweta Fertilizer Company went into operation three weeks ago at Newnan, A couple of months ago active work was begun, and now a $50,000 plant is in operation, making one hundred tons of sulphuric acid a week.

The method is to burn Spanish ore containing 53 per cent of sulphur and 47 per cent of iron. When the furnace is once heated the sulphur in the ore is all the fuel that is needed. The sulphur gas has some oxygen, but not enough to make sulphuric acid. To supply this deficiency nitrate of soda is burned and forms a gas which carries oxygen. The two gases are carried into an immense lead chamber with a capacity of one hundred thousand cubic feet. Here chemical action takes place, the result of which is that oxygen goes from one gas to the other, and gives the sulphur gas enough oxygen to make sulphuric acid. The acid takes the liquid form and sinks to the bottom of the chamber. This process fills the bottom of the chamber about four inches deep in a week. It is so large that every inch of the acid in the bottom amounts to twenty-five tons.

It is said that the Spanish ore costs, delivered, $9 a ton, and two tons will make as much sulphuric acid as one ton of Sicilian brimstone, which costs, delivered, about $36. Here is $18 against $36 for material ; but, of course, this is not all saving, for it costs more to manipulate pyrites than brimstone in the manufacture of sulphuric acid. The residuum of the burnt ore contains at least 90 per cent of iron, and must become an important feature in the economy of acid manufacture. So far it has required a larger quantity of coal to melt the iron ores at southern furnaces than at others. because of the low percentage of metallic iron. A mixture of the rich residuum of pyrites after the sulphur has been burnt out would probably reduce the proportion of coal needed to melt iron ore of less richness. This fact is well recognized in Spain, and the companies who mine and ship the pyrites make it a part of the contract that the residuum shall belong to them after the sulphur has burned out.

Condition of Miners in Hungary.—The number of persons employed in the mines of Hungary is 35,533, of whom 29,830 are men, 5000 are boys from twelve to sixteen years old, and the remainder are women. The average daily wages earned in the mineral mines are seventeen to nineteen pence, and in the coal mines, twenty-five to thirty-one pence. In the mineral mines the work is usually carried on at night, but if day work is done, there are three shifts of eight hours. In coal mines work is usually done in two twelve-hour shifts, with an allowance of two hours in each shift. The miners are usually lodged in houses built by the companies, who also sometimes supply necessaries at cost price. Strikes are rare and are of short duration.

Manufacture of Patent Fuel.*

By James Clark.

In consequence of the enormous increase in the output of coal during recent years, a proportionate increase has taken place in the amount of small coal brought to the surface. Where screening is carried on extensively there is a great deal of very small coal made, and there are only two ways to dispose of this small, viz.: either to coke it where the quality will suit for that purpose, or manufacture it into patent fuel. Until quite recently the various processes used have been regarded as trade secrets, and the works in most cases shut against strangers.

The first recorded attempt to introduce the manufacture of fuel into England was in the year 1594, and is described in a work by a lawyer named Sir Hugh Platt, entitled "A new, cheap and delicate fire of cole balls." He describes his project as one to sweeten sea coal so as to make it a substitute for wood in domestic economy. He then describes how he made it by mixing loam in a tub of water and making it into a very fine pap and then mixing it with sea coal which had been previously bruised with a hammer.

The word patent was first applied to artificial coal in 1799, when the Marquis of Ohambannes obtained protection for a suitable process, his object being first to prepare large from small coal by passing the latter through seives made of wood or metal, and secondly consolidating the small coal by mixing it with earth, clay, cowdung, tar, pitch, broken glass, sulphur, sawdust, oil cake, wood, or any other combustible ingredient.

There are about 385 specifications relating to patents for inventions of artificial coal made from small coal, between the years 1799 and 1885, some relating to the machinery employed and some relating to the process of manufacture.

Fuel making did not become aa important production for steam generating until after many costly experiments had been made; and of all the materials tried pitch remains the only one in regular use. The methods of making fuel may be grouped under three heads:—

First—Processes requiring drying in an oven after compression, such as the Farina process, which was thoroughly tried a few years ago and which completely failed.

Second—What is called the dry process, which is still used to a certain extent and which consists in passing coal and pitch through hot cylinders over a furnace.

Third—The steam process, which effects the melting of the pitch by means of hot dry steam.

The last mentioned process is one which is now almost universally adopted. The coal owners on the continent go in more largely for fuel making than we do, and I am sorry I cannot describe some of their appliances, but probably some of the other members who have seen them may be able to furnish some particulars in the discussion of this paper. The home of the fuel trade in this country is South Wales, where from 10,000 to 70,000 tons per month are shipped abroad. Blocks of various sizes are made, and some of the works made what they call "ovoids' for shovelling into the furnaces; they are egg-shaped.

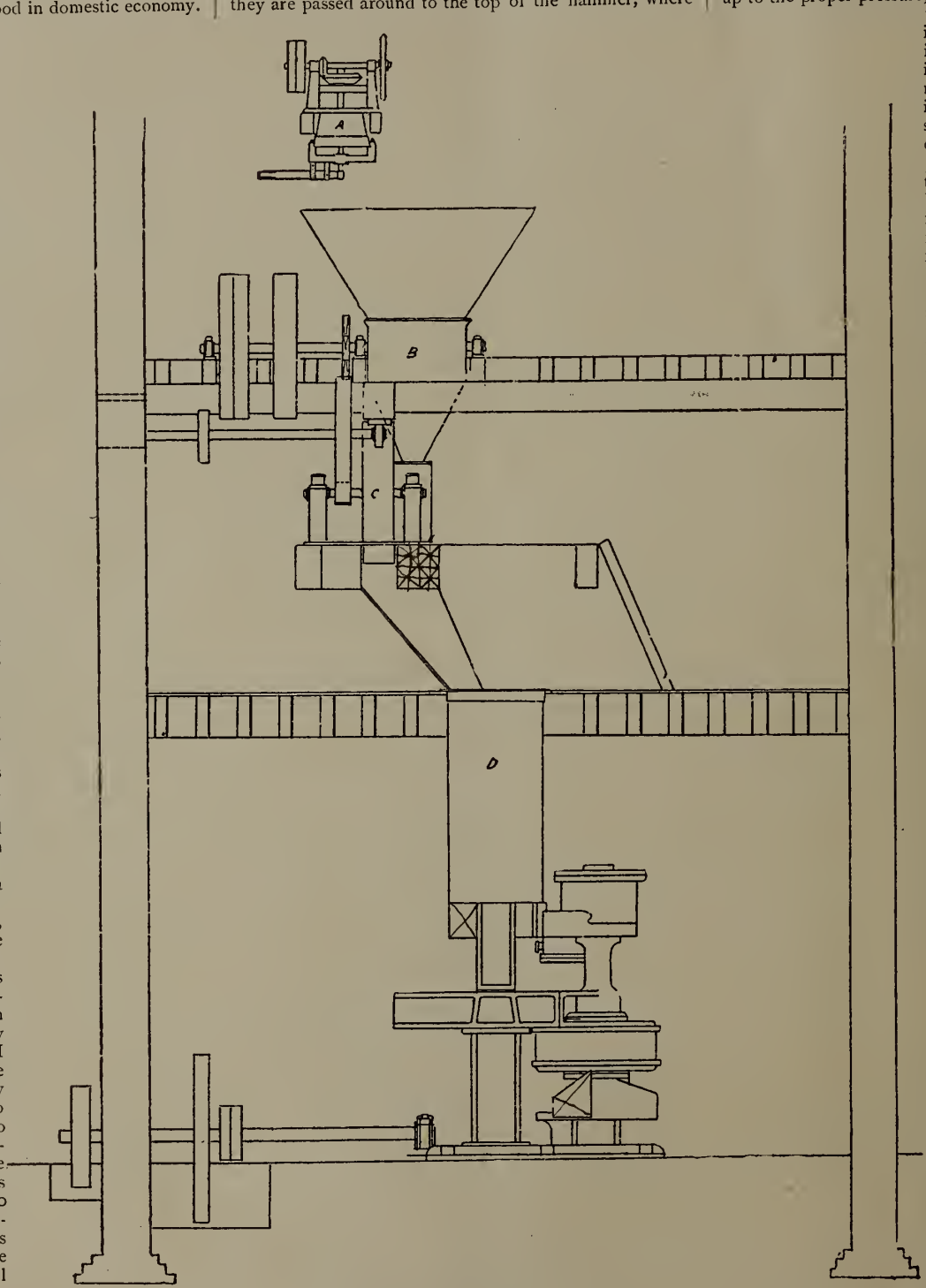
The most modern complete factory erected in this country is that at Newport in Monmouthshire, where the whole arrangement for receiving the coal and converting it into fuel and shipping it into the holds of sea-going vessels is complete. At these works about 400 tons can be made per day.

Patent fuel possesses the advantage over coal of requiring less storage, as a ton of fuel occupies 31·5 cubic feet, as against 41 cubic feet for coal.

The calorific power as against coal is slightly less when the coal is fresh worked, but fuel can be kept a long time, showing no depreciation after years of exposure, whereas coal would be valueless if kept a very short time.

Fuel up to the present time has been little used for domestic purposes in consequence of a prejudice against the smell of the pitch, but this is gradually wearing away.

I will now describe a small plant erected at Ormeston Station Colliery two years ago by the Uskside Engineering and Rivet Company (Ltd.) As shown on Plate LXII., A is a small pitch-mill fitted on the top of the hopper; B is a distributer for dividing the proper quantity of coal and pitch; C is a disintegrator for grinding and mixing the coal and pitch together; D is a pug-mill, where the coal and pitch are stirred and heated to the proper consistency for compression. B2 is a pan-mill to receive the coal and pitch, with revolving arms in it to fill the moulds; C2 is the press cylinder for pressing the blocks; D2 shows the amount of compression, 2½ inches on each block, which equals 12 cwts. pressure to the square inch of block surface. D3 is where the block is tilted off after it is finished; E is a section of the stamper that presses the block; F is the lever on the end of the piston rod that lifts the stamper by means of what is called a hammer, resting on the centre of this levér. When the moulds are filled the table is turned around horizontally, a tooth at a time, by a kicker on the upright shaft that passes through the pug-mill to the top of it, and they are passed around to the top of the hammer, where the blocks are pressed. After they are pressed they are passed on with the stampers rising on an inclined plane, and when the moulds get to the opposite side of the press from the hammer, the blocks are above the level of the table and are tilted off there, and then the stampers are passed along on a descending plane into the pan mill for filling. Immediately above the pan-mill, and on the bottom of the pug mill on this upright shaft, there is an eccentric that works the slide valve of the press cylinder and causes the piston to give the blow. The whole of this machinery is driven by a pair of coupled engines, 10 inch cylinder and 20 inch stroke, supplied with steam at 40 lbs. pressure. The speed of the engine is 60 revolutions per minute. The speed of the main shaft of the full plant is 95 revolutions per minute. The pug mill and press cylinder are supplied with steam at 70 lbs. pressure from a small multitubular boiler, 7 feet long by 3 feet 6 inches in diameter, with 28 tubes of 3 inches internal diameter. It required one man on the top to fill in the coal, one boy to fill in the pitch, one pressman on the bottom floor to attend to the press and pug mill, two laborers to take away the blocks and load or store them, and one boy to fire the boilers; in all four men and two boys. The machine turns out 3 tons of fuel per hour. The quantity of pitch used is from 9 to 10 per cent. of finished fuel. This process is similar to Yeadon's; but we consider it a much shorter cut, and the mode of pressure in this case is much safer, because if the table does not come exactly to the very same place, the hammer gets a hold of the stamper all the same; and if anything were getting into the mould, the hammer would simply put on the usual pressure and return without doing any harm, which would not be the case if two hammers or plungers were applied, as in Yeadon's; they would require to travel the full distance or break something. In our experience we find the principal things to attend to in making good fuel are to see that the proper quantity of pitch is filled in along with the coal; that they are both properly ground and mixed in the disintegrator; that the steam for the pug mill is kept up to the proper pressure, and that the nozzles conveying the steam into the pug mill are in order. We have two nozzles into the pug mill; one about 12 inches from the bottom of the mill, and another about 6 inches further up on the opposite side of the mill. The diameter of these nozzles is from ⅜ in. to ½ in., screwed into a ¾ in. tube. The height from the bottom floor to where the coal is filled into the hopper is 23 feet. The small coal, as it comes from the coal miners, is emptied by the pit-head-man into a well made to receive it from the screening platform. The pitch is hoisted up an inclined plane in hutches to the same platform, and emptied on the opposite side of the hopper.



Patent Fuel Machine. Fig. 1.

Before we erected this plant we stored hundreds of tons of this gum in the workings; now it is all drawn, and whatever is left over after supplying the colliery with steam is made into patent fuel. Our coal is so soft and drossy that we entered into an arrangement with our coal miners when we first opened out the colliery, to riddle all the coal over a ⅜ in. riddle, and that enabled us to make a better job of screening it into peas and nuts for the market.

The size of the briquette we make is 6 inches by 4 inches by 3⅝ inches, and it weighs four pounds. We only make one size. Stevenson Macadam, Esq., Ph. D., Sc., Lecturer on Chemistry, Edinburgh, says in his analysis of the fuel, that the patent fuel manufactured by the Ormeston Coal Company proves that it is of excellent quality for general combustion purposes. It is well made, burns freely and evolves a good heat. The fuel is of first class quality for household purposes.

* Read before the Mining Institute of Scotland.

The Ore Fields of Peru.—According to a recent report of the U. S. minister at Lima, petroleum promises to become the most important industry of Peru, the oil fields being said to cover 7,500 square miles, while the Pennsylvania oil region is confined to somewhat narrower limits. The refined kerosene manufactured by the London & Pacific Petroleum Co, at Talara, near Paila, in northern Peru, has so far displaced the American article that it is impossible to purchase any thing but Peruvian kerosene in Lima. The first shipment to this market from Talara was made in Dec., 1889, and now almost the whole west coast of South America is supplied with the Peruvian article. Three new companies with large capital were organized in London during the early part of the current year, for the purpose of working the petroleum beds between Paita and Tumbfer.

The Use of Block Petroleum in the Navy.—It is stated that experiments with block petroleum in a torpedo boat have been made under the auspices of the Admiralty at Davenport. The object is to ascertain its actual value as a fuel. The great objection that experts have hitherto had to liquid petroleum is that it would require specially constructed boilers in which to burn it, which could be provided only at enormous cost, while it would also require specially constructed tanks for storage purposes. It is said that block petroleum is really much more powerful as a heat-giving agent than coal, and it is possible to attain a speed of 3 knots an hour more in a given time than would have been possible with ordinary fuel.

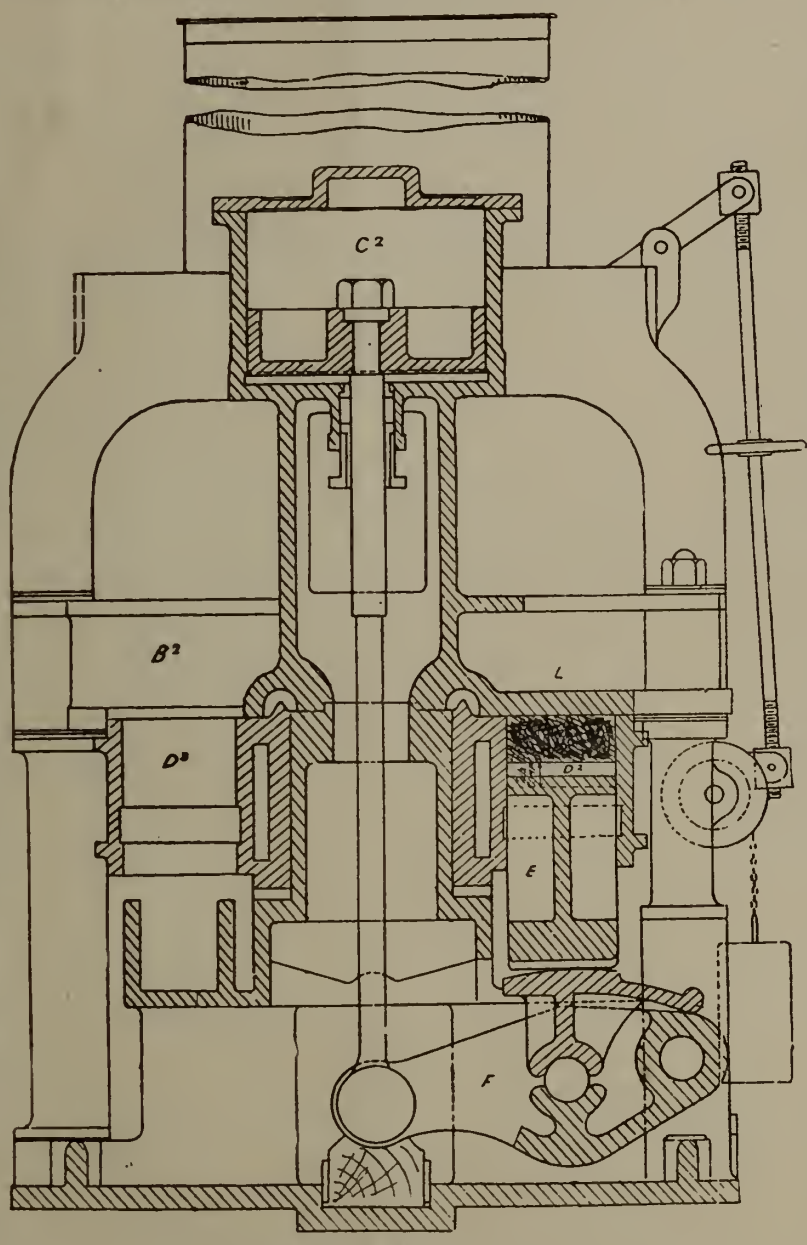
Draining in Mines.*

By Mr. Henry Davey, M.I.C.E, Westminster.

The author dealt with some of the leading general principles involved in methods of draining mines under the most important conditions of both coal and metalliferous mining. In treating of draining during sinking operations, he said the conditions vary greatly in sinking for coal or for ore. In the former case the shaft or pit is usually completed before the coal is worked; in the latter the shaft is generally deepened during the working of the mine, and is, therefore, never in a permanent condition. Temporary steam pumps might be used to advantage for small quantities of water from moderate depths, but for any important work a surface engine with bucket pumps, having proper lower appliances, should be adopted. Pumping water was not a costly operation if proper and sufficient pumping plant was employed for the work; but if this plant is insufficient the loss often is very serious. Even with proper plant, sinking through water-bearing strata is slow and costly, because of the delay occasioned by the sinkers having to work in water. Heavy pumping under such conditions could be expedited by the use of jet pumps and other auxiliary appliances, by means of which it was unnecessary to lower the main pumps so frequently. Hydraulic pumps might be used to great advantage. Many special appliances of this nature might be employed if they could be procured when wanted, but no one kept special appliances. Makeshift plant was procured and the sinking in consequence became slow and costly. The author said that for many years he had been convinced that a sound investment would be found in the establishment of a depot where the best sinking appliances might be obtained on hire or purchase. In sinking shafts and wells through water-bearing strata, great cost was usually incurred and much time taken up. The subject was of considerable local importance because of its bearing on the sinking of mining shafts. The problem was simply that of keeping down the water in water-bearing strata in advance of the sinking operations, so that the excavation of the shaft should be done in dry ground. The ordinary method was to sling a pump or pumps in the shaft, and to lower the pumps from time to time as the sinking progressed; obviously the excavation had to be performed in water, and if the quantity of water was great a large portion of the work had to be done by the men working in two or three feet of water. To facilitate the work and reduce the water in which the men had to work, a sump was made under the suction pipe of the pump, and it was the keeping this sump excavated in advance of the other work which was most difficult and tedious.

In the plan proposed by the author the pump would be placed in a borehole made before the commencement of the sinking of the shaft. It was necessary that *debris* should not go down the borehole in quantity sufficient to choke it up. That is provided against by means of a heavy taper shield of cast steel surrounding the pump and resting on the edge of the borehole. This shield is perforated with holes inclined upwards towards the pump, to allow water to get into the borehole, but to exclude *debris*. The shield is made very heavy, and by its own weight follows the excavation around the pump and also protects it from injury through the blasting of the rock. The pump is made without a foot valve, the rod of the bucket working through the seating of the valve which rests on the top of the working barrel. By this arrangement the drawing of the bucket also draws the valve, and should the bottom of the borehole be filled up with sand it can be removed by lowering a sand pump. The bore holes should be made to a greater depth than that required for the pump, to provide space for sand and *debris*. The application of this pump would be varied to suit the local circumstances and the geological formation of the strata to be passed through. In some situations the shaft might be drained by means of boreholes outside. It was usual and necessary to have duplicate pumping engines, and where two engines were made to pump from the same well, the well must be very large to accommodate two sets of pumps. Such wells were usually from 12 to 14 feet in diameter. A simple borehole could be made cheaply and expeditiously. Four 30-inch boreholes could be put down in a small fraction of the time required to sink a 12-foot well in the ordinary way. Instead of making a large well the author puts down four boreholes to accommodate the pumps for duplicate pumping engines. The boreholes being completed, the pumps are lowered into them and coupled up to the permanent engines. The author held that it was true economy to have a pumping engine large enough to do the work at half or even one-third its full speed, or what might be called two or three times too big. He was at present putting down large pumping plant at great cost to recover a colliery drowned because it was formerly drained by means of underground steam pumps. The practice had been to put down a new pump for every new feeder, but one day a big feeder broke in and the pumps were soon under water and the colliery also.

Underground pumping engines had been largely employed of late years, but the author thought it a mistake to take steam underground. It was not possible to get dry steam to underground engines through pipes carried down the shaft, and with wet steam the engine would give a low duty. He had found the engines on the surface could be made to work with one-half the steam required by the best underground engiuess for the same work. In some places underground pumping engines were more suitable than surface engines, but in most of such cases the pumping was better and more economically done by means of hydraulic pumps from an engine on the surface. He instanced the installation of Messrs. John Denton & Co., at the Grimesthorpe Colliery, Sheffield. The work was previously done by means of steam pumps, but the steam was such a nuisance underground, the mine was made so hot, and the steam pipes and plant gave so much trouble, that Messrs. Denton resolved to try another plan. The shaft is an inclined one. There are three hydraulic pumps placed in different parts of the mine.



Patent Fuel Machine. Fig. 2.

The first lifts 150 gallons per minute, 300 feet high; the second, 137 gallons, 300 feet high; and the third, 30 gallons, 300 feet high. The power is supplied from the surface through pressure pipes 4 inches, 3 inches, and 2½ inches in diameter, at 700 pounds per square inch. The pumping plant cost £1,547 and the pipes £517.

The author stated that he had devoted considerable attention to the system of applying hydraulic power to underground machinery, and he gave particulars of the hauling and pumping engines at Altham colliery, the New Russia Company's collieries, and the Quebrada copper mines. He expressed his conviction that for vertical shafts, where considerable quantities of water had to be dealt with, the pumping could be more safely and economically performed by means of surface engines and pump rods than by any other means. Where, however, their use is inadmissable, the system of hydraulic transmission is the most economical, convenient and practicable, not only for pumping, but also in many cases for hauling purposes. Conveying steam underground for pumping purposes was to be avoided, if possible, except under very special circumstances. The author mentioned that several installations had been put down for pumping by electrical power. He also cited a colliery near Marseilles where three hydraulic pumps were placed in different parts of the mine, which is 1,100 feet deep.

In opening the discussion Mr. Bagley, the president, said that with regard to the establishment of depots where pumping machinery might be hired, he thought that an idea which mining engineers would readily approve. Members of the institution would remember that some fifteen years ago they visited the Whitburn colliery. At that pit an extraordinary amount of water was encountered during the sinking operations, and the pumping machinery was quite inadequate to cope with it. A depot for mining machinery would have been greatly appreciated by the owners, but resort had to be had to the various marine engine building works on the Tyne and Wear, and marine engines were planted, with very little foundation, all around the mouth of the pit, these doing duty as pumping engines. These improvised pumps enabled the company to keep down the water, and the pit was thus saved from being drowned out. Eventually the Chaudron process was adopted and the sinking completed. This was an illustration of what would be the value of a central depot such as Mr. Davey apparently proposed, available for all England.

A letter was read from Mr. Addison L. Steavenson, chief mining engineer for Messrs. Bell Bros., and the oldest mining engineer connected with the Cleveland mining district. He was unable to be present, but stated that hitherto they had escaped the necessity of having any very powerful permanent pumping engines. When sinking Lumpsey mine they passed through feeders of 1,700 gallons per minute, and at North Shelton the officials stated that they were favored with thrice as much. In both cases they were shut off by metal tubing, leaving the mine quite dry below, but they remained above only so long as they did not work the pillars. A short time since he looked at the question of how best to deal with it, and it seemed to him then that one or two of Mr. Davey's engines placed in the centre of a basin, or at some point which would allow the deepest point to be reached by an underlevel drift, and so avoid a very heavy column, would be the best way, the various mine owners combining in a joint scheme. If the discussion was adjourned, he could perhaps attend and explain this scheme fully when he had got the consent of the parties interested.

Mr. Jeremiah Head, M.I.C.E., Middlesbrough, quite agreed with the remarks of the author as to the difficulties of sinking operations where there was an excess of water. They could not get pumping engines made in a hurry to cope with an influx of water. He knew of one case in the Forest of Dean, with which he had to do. They had had much difficulty for three years in carrying on operations, owing to the lack of proper pumping machinery. They had gone about the country getting machines wherever they could. He thought if a depot were established for mining machinery it ought to include other things besides pumps. There ought to be apparatus for combatting colliery disasters, such as helmets, etc., for enabling explorers to enter workings filled with noxious gases. Mr. Davey had explained the system of pumping that he advocated. The old system with the suction valve right at the bottom of the sinking, and the motive power a long way off, and conveyed by spear rods, seemed to him cumbrous and awkward. Instead of rods Mr. Davey carried down water in pipes. The system was a good one, but yet it seemed to him it had its disadvantages in the slowness with which the pumps would work and the liability of the water in the pipes to freeze and stop the whole concern. Mr. Davey rather advocated the supply of water to towns for domestic purposes from wells in preference to gravitation schemes. It would be particularly interesting if Mr. Davey would indicate the precise geological strata in which they might rely upon getting any great quantity of water.

Mr. T. D. Ridley, Redcar, said his experience had mostly been confined in respect to draining water, to the clearing of it out of foundations, etc. In constructing the Thames embankment he began to use chain pumps, which were seldom seen in these days, and were not considered economical. But he found that for the purpose of clearing foundations they were most economical; they would lift almost anything, and could be relied upon not to break down. He had used chain pumps a good deal ever since. It was a good point to keep the pump considerably in advance of the excavation. He knew the importance of having the men kept dry and working clear of the water. If they could keep the shaft dry by putting down boreholes outside of it there could be no difficulty in keeping the men dry. He had been draining the town of Henley-on-Thames, and had met with much difficulty in sinking shafts, but if he had put boreholes down outside each, as Mr. Davey suggested, the work would perhaps have been more economically carried out.

Mr. William Hawdon asked if the system could be carried out in very soft ground, because it appeared that if they bored a hole without tubing it the ground would fall in and choke the pumps.

* Abstract of paper read before the Cleveland Institution of Engineers, Middlesbrough, February 22, 1892; with discussion thereon.

Mr. Illtyd Williams, Linthorpe Ironworks, enquired whether the shield and tubing were not liable to be fractured through the use of explosives near them.

Mr. Davey, in reply, after answering a query about the sure of the jet pump, said the president had alluded to the suggestion for the establishment of a depot where proper sinking appliances might be kept. The speaker explained that what he meant was that specially designed machinery, rather than ordinary machinery, should be kept. He agreed that apparatus for contending with sudden influxes of water, for use in accidents, etc., should be found there. The only danger of the water freezing in the tubing was at the top; the heat of the mine was sufficient to keep it all right further down. Where it was liable to freeze, a small quantity of glycerine was added to the water. With regard to boreholes in soft ground, they would have to be lined to keep the ground from falling in, and in some cases it would be necessary to put tubing all the way down. The shield and tubing were made exceptionally strong to resist the effects of shots.

Underground Surveying.

In a work bearing this title, and which is now being prepared for the press by a mining engineer, directions are given for the use of the improved Hedley dial, made by Messrs. John Davis & Son, Derby. It is stated that the magnetic needle without a check is not a safe guide in underground surveying. Any person who will attend to the directions given in the work, and re-make a survey wherein no attention has been previously given to magnetic attraction, will require no further argument to convince him that a survey made with a rigid dial is at best a very doubtful operation. Ferruginous substances are plentiful in almost all mines, some visible enough, some, however, not visible to the senses of the surveyor. Such substances act upon the needle of the dial, and if no method be adopted to measure the amount of the attraction or to dispose of its erroneous readings, these surveys must be doubtful and worthless, and cannot be otherwise than a source of disappointment and perhaps disaster. The costly and cumbersome theodolite is out of all question for general use in mines, and its angular readings give no idea as to the separate bearings of the headways, and no check is obtained to the readings. The new and improved Hedley dial not only meets all the requirements of the mining surveyor, but by its aid surveys can be made with mathematical certainty. It is often found in using old plans of collieries that magnetic readings have been solely relied upon, and that disastrous results have occurred in consequence of the magnetic attraction giving the wrong location of old workings. It is time some good and reliable instrument was invented; it is also time some clear, plain and reliable method of underground surveying were lucidly explained for the use of colliery managers and learners, so that surveys, when made, may be affirmed to be accurate—certain—and as far as possible admit of demonstration. The improved dial counts from the north from left to right 10, 20, 30, 40, etc., and the outside check figures commence at the vernier, and, by so arranging the figures to facilitate their reading by the operator, also count from left to right 10, 20, 30, 40, etc.. In commencing an underground survey, the following directions are given by the author.

Do not really commence at the pit's eye, because it is next to impossible to get a true reading on account of substances of iron. Select some disused road (such are to be found in most pits) and take from two separate stations its magnetic bearing, then tighten the collar attached to the ball and socket, slacken the clamping screw, turn the sights of the dial by means of the rack and pinion screw, until the vernier reads the same degree as the bearing just taken. The bearing and length thus taken will serve as the bases of subsequent operations. Then tighten the clamping screw and slacken the collar, and by means of the loose collar direct the sights of the instrument between the same stations as before, and if the needle and vernier readings are the same, the dial is in adjustment to survey the whole of the undergound workings from the base line just taken. We will suppose, in order to be understood, the bearing of the needle and the vernier reading to be 40 degrees 200 links. Set up the instrument on the end of the line from which you wish to continue the survey, and by means of the loose collar direct the sights to the other end of the line, and if the angle reads as we have supposed, 40 degrees, tighten the collar, slacken the clamping screw, and by means of the rack and pinion screw direct the sights to the next station, which suppose to read 30 degrees 100 links. Again tighten the clamping screw and slacken the collar, and move the instrument to the next station. Set up the instrument truly over the station, and by means of the loose collar direct the sights to the last station. [If the needle and vernier readings agree, there is no attraction. If they differ, the amount of magnetic attraction is the difference between the magnetic and vernier readings. The vernier reading must always be taken in preference to the magnetic, because it will be found in practice that, when there is no attraction, the magnetic and vernier readings will again agree, and this will be found the case throughout the survey, and give undoubted proof that the work is right.] Again tighten the collar and slacken the clamping screw, and by the screw of the rack and pinion direct the sights to the next station which suppose to be 20 degrees 100 links. Then tighten the clamping screw and slacken the collar, and move the instrument to the next station. Fix the instrument truly over the station, and by means of the loose collar direct the sights to the last station. Then tighten the collar, slacken the clamping screw, and by means of the screw of the rack and pinion direct the sights to (we will suppose the pit shaft) the next station, which is 10 degrees 100 links. It is here necessary to observe two things:—First, that in all the sights taken in the direction of the pit shaft, the eye of the surveyor must be at the north sight, and, in taking a sight from the pit shaft, must be at the south sight. Secondly, if, as we have supposed, the base line is some distance from pit's eye, the survey notes must be entered from the top of the note book downwards, instead of upwards as is usual. Then the bearings and the notes will be precisely the same as they would have been had the survey commenced at the pit shaft. The plotting also may be done as in ordinary cases.

In every survey, by using the improved Hedley dial, the work is verified as it goes on, the true magnetic bearings being registered, which cannot be said of any other instrument, the theodolite not excepted. If no disused road can be found in the pit, then get up the tram rails, say, for 20 yards, and remove all other iron for the same distance, so that one magnetic bearing may be obtained without attraction. The survey may then go on as before described. It may perhaps be advisable here to note that some line used in making the surface survey, (say, the base line, or some principal line) should be marked out upon the surface by fixing in the ground at least two or three permanent marks as stations, and corresponding marks and stations legibly marked upon the colliery plan. The mining surveyor may then at any time check the pit shafts and boundaries, and prove the accuracy of the plan. If the surveyor will take the bearing of this line, he can draw the magnetic meridian for any instrment. It is a fact that different instruments, especially if they are made by different makers, vary in reading the same line. The writer has known them vary 1¾ degree; but if the foregoing directions are attended to, and the bearing of some line taken, and the magnetic meridian fixed accordingly, uniformity, instead of diversity, would be the result. This method also will meet the difficulty of the variation ot the compass, because the true magnetic meridian may be fixed at any time, and as often as it is considered necessary by the surveyor.

Testing for Gas in Mines.

This was the seventh of a series of lectures arranged by the Midland Counties branch of the National Association of Colliery Managers. Prof. Clowes, who illustrated his subject by many interesting experiments and also by means of diagrams, pointed out that the term "gas testing" should refer only to the best ways of detecting the presence of low percentages of fire-damp in air, and of measuring this amount. This involved the careful use of an appropriate safety lamp or other apparatus. Any form of safcty lamp in unskilled hands would indicate proportions of fire-damp exceeding about 6 or 7 per cent.; such mixtures made the flame increase in size, and then flare and flicker, or they totally extinguished it if the proportion of gas was high. Then signs of the presence of gas could not be mistaken, and they were supplemented in some of the less perfect forms of lamp by the burning of the gas itself inside the lamp. When the proportion of gas to be detected fell below 2 per cent., however, only the careful use of a suitable lamp or apparatus would serve to detect it and increase its amount. It might be urged that very low percentages of gas needed not to be detected, as they gave rise to no risk of explosion. This statement, however, certainly required qualification, in the light of what was now known with regard to the influence of the presence of fine coal dust. Air containing less than 2 per cent. of gas became explosive if it was mingled with coal dust, and accordingly in dusty mines percentages of gas less than those which could be found by an ordinary lamp, must undoubtedly be looked for. Then, again, in order to test the sufficiency of the ventilation, and more especially to ascertain that the air reaching the mine by the downcast was properly divided up into the splits, so that each split got its full share, it was absolutely necessary to ascertain periodically the percentage of gas in the "returns." The percentages of gas to be determined in the returns would nsually be below the lowest quantity detectable by an ordinary safety lamp. If there should exist amongst managers any unwillingness to use the most perfect means of gas testing, simply because they did not wish to know the worst concerning the state of the ventilation of their mines, either as regarded its amount or its proper distribution, the feeling must surely give way in the present age of scientific progress, and in view of the preventable danger which was incurred by such recklessness. The only satisfactory and trustworthy methods of gas testing at present known depended upon the fact that even the smallest percentages of gas in air, which could not be kindled by a flame, would yet burn completely if they were kept in contact with a sufficiently hot surface. The most satisfactory gas indicator as yet produced was that of Liveing, of which Prof. Clowes gave an interesting description. The only objections which seemed to be raised to the use of this apparatus in the mine were, that it was costly; that it necessitated the carrying of a special apparatus, and that some trouble had arisen from the spirals being rendered useless by fusion of the metal, caused by over heating them. If no simpler and less costly and troublesome apparatus was available, these objections surely were not of very great weight, and seemed insufficient to account for the neglect with which the apparatus had been treated since its invention in 1880. The lecturer also referred to the apparatus devised by Maurice, which he described as sound in principle, adding that it was doubtful, however, whether it was as simple in practice as that of Liveing. Speaking of the "flame cap" test, he said that its delicacy had recently been vastly increased. The examination of lamps specially designed for gas-testing had been undertaken in Prussia, and had resulted in the recommendation of an extremely sensitive lamp devised by Pieler. The examination of the sensitiveness of certain modified lamps had also been reported upon by a Royal Commission on Accidents in Mines. More recently the lecturer had devised a special apparatus for the purpose, and his experiments had thus far had the result of proving that the Hepplewhite-Gray lamp, as modified by Mr. James Ashworth, was capable of detecting and measuring extremely low percentages of gas. In the latter they had a lamp which was at once a good lighting and a good testing lamp. Probably more might yet be done in the matter of producing safety lamps, and an arrangement for gas-testing might be applied to a lamp which would free the lamp from the reputed danger of burning benzoline, or inflammable spirit of any kind, and yet give good flame caps. What was to be desired was a flame which should not only be pale, but bright and sufficiently large. As far as his experiments had gone they indicated that the flame of burning hydrogen fulfilled all the conditions required for very delicate gas testing. He should probably have more to say about that in a future lecture. Prof. Clowes described an apparatus which he had constructed for testing the sensitiveness of lamps for gas-testing. The apparatus furnished a ready means of testing the sensitiveness of safety lamps as gas indicators, and he was at present applying it to other matters of interest in connection with gas testing.

Amalgamation Without Overflow.

[Australian Mining Standard.]

One of the biggest difficulties those interested in gold mining have had to face for many years past is the saving of fine gold by the ordinary battery and pan process. A number of the mines in this colony, and for the matter of that throughout Australia and New Zealand, promise very rich returns when first discovered. Huge lodes, such as the old Junction Reefs (now Mandurama), with gold well distributed throughout, due in most cases, it is presumed, to thermal spring action, look like becoming dividend-paying properties as soon as the battery starts working. Bitter experience teaches another lesson; the first crushing often is the last, or at best the mine struggles on, until, tired of paying calls, shareholders drop out one by one, and what promised a fortune, oft times spells ruin. Why is this? Simply because the mercury is unable to seize the gold, the rush of water from the battery carrying the fine particles away on its surface, or worse still, forming a kind of solution. Chlorination, of course, is specially suited to this type of ore, but in many cases, where large dykes or lodes have to be put through, as at Pambula, in New South Wales, and at Kuaotunu in New Zealand, chlorination is far too expensive a means of extracting the gold where a mass of low grade ore has to be put through. Recent experiments at the Ballarat School of Mines have proved that a deliverance from these difficulties is at hand from an unexpected quarter. The despised Chilian mill and Wheeler pan, discarded at many mines, will solve the problem, but the keynote of success is amalgamation without overflow. Dispense with the overflow and the gold is saved. Two typical mines—the Great Mercury Proprietary gold mine, of Kuaotunu, N.Z., the other the Pambula—have lately been conducting a series of experiments with the object of saving their fine gold in an economical manner. The last and best trials made by these companies were at the Ballarat School of Mines, where amalgamation without overflow was put to a crucial test, in each case with the gratifying result that 96 per cent. of the precious metal was secured. What this means to the Great Mercury mine, for instance, can easily be imagined when it is understood that notwithstanding all the latest gold-saving adjuncts during the last six months, 1,260 tons of ore worth £4 17s 10⅔d. a ton have been put through for a saving of £1 9s 1⅔d. only, or in other words over two-thirds of the gold has gone to waste (for the time being) in the tailings, and in the tailings at the present moment lie the dividends that should have cheered shareholders' hearts. And now for the *modus operandi*, which, it must be remembered, is not hedged in big royalties to anyone, rights, patent or otherwise. The ore to be treated is first calcined, then put through a rock-breaker or stamper battery in a perfectly dry state; if the battery is used, ordinary precautions, of course, must be taken to prevent waste, or the dust becoming obnoxious to the workmen. The ore is then tranferred to the Chilian mill and made to the consistency of porridge, the quicksilver being added. When the principal work of amalgamation is done, experience soon teaching the amount of grinding necessary, from the Chilian mill the paste (so to say) is passed to a wheeler or any other good pan of a similar type, when the gold-saving operation is completed.

Russian Petroleum.—A recent report by the United States Consul at Batoum furnishes statistics of the condition and progress of the Russian petroleum trade. The production of crude oil in the Baku district during 1890 averaged nearly 80,000 barrels, of 42 gallons each, per day, as against 68,000 barrels daily in 1889. Early in 1891 the amount was increased to as much as 125,000 barrels a day, owing to the flowing of four new wells. In 1890 the high prices greatly stimulated drilling, and the increase in the production of all petroleum products over 1889 was 36,342,075 gallons, of which 32,277,235 gallons were exported.

MINING NOTES.

[From Our Own Correspondents.]

Nova Scotia.

In General.

The suit of Stuart vs. Mott, for an interest in the proceeds of the sale of the Dufferin mine in March, 1889, will be heard at this session of the Supreme Court in Halifax.

Caribou District.

The Lake Lode Co., once managed by L. L. Wadsworth, is advertised to be sold by the sheriff early in April, under attachments for debt.

Goldenville.

Little is doing in this district. Messrs. Miller have acquired the old Coburg property, and have pumped out the shaft and cleaned it up preparatory to undertaking work in early spring.

Killag.

The Provincial Co., which is operating the property purchased from Messrs. Stuart *et al*, have decided to sink a new shaft on the Stewart lode, some 300 feet further east, and to erect over this shaft (which will be a vertical one) a combined shaft house and stamp mill building. The plans for this structure have been fully prepared, and Mr. D. S. Turnbull, of Beaver Dam and Renfrew, has been engaged to superintend its erection.

Malaga.

The original pay chute of the Rabbit lode has been cut by the Malaga Mining Co. in a shaft some distance to the westward of the older workings, and the quality of the quartz is reported to be better than has ever been taken out of this lode before, which, to those knowing the lode, means very rich quartz, as this lode has given returns of several ounces to the ton. This company has shown a balance on the right side of the ledger for some time now, and the business management of Mr. G. A. Wade, the manager, is an example for other companies who have good mines which are not profitable.

The Boston Gold Mining Co. is rapidly approaching its boundary line in working out the pay chute. Unless precautionary measures are taken this company will soon have low grade ores to mill.

Montagu.

Men are being laid off in this district, the management of the combined mines having decided to curtail work and expenses for the present.

Oldham.

The Standard Gold Co. are using air drills in driving levels (the 150-ft. and 450-ft.), but have adopted hand-drilling for the stopes, having found that hand-drilling in the back stopes gave the best results.

The vertical shaft of the Napier Mining Co. is going down very slowly owing to the water, hardness of the rock and peculiar folding of the rock encountered. So far nothing of value or importance has been cut, and at the present rate of sinking it will be July 1st before the workings reach the objective point.

Renfrew.

Attachments are the order of the day apparently, as this is the third district within a month which has had attachments made for debt. The employees of the Empress mine attached for wages due, but there is no likelihood that an execution will be issued, as funds to pay all bills are understood to be en route for the mine.

Stormount.

The sale of the North Star Company's property is advertised for April 20th. Rumors are afloat that a stay of proceedings will be issued on behalf of an interested creditor, and that the property is likely to be idle for some time.

South Uniacke.

Messrs. Thompson & Quirk deny the report that they intend erecting a new mill, but a new engine will be placed in the existing mill. The quartz from this mine maintains its high grade character of from 10 to 20 ounces per ton. [Official returns of the yield from this property from October, 1889, to 31st December, 1891, report a yield of 3,201 ounces 15 dwt. gold from 298 tons rock crushed.]

Whiteburn.

Mr. G. J. Partington desires us to make correction of the news item concerning the Graves mine, which appeared in the February issue. Although the mine has not been operated on *company account* for some months past, yet Mr. Partington, as manager of the Whiteburn G. M. Co., has permitted certain portions of the property to be worked *on tribute*, the product for February from that source being 38 ounces from 37 tons. Mr. J. M. Reid, whose name appeared, has no connection with the mine whatever. The programme of the company for the coming summer has not yet been made public.

Waverley.

The West Waverley Gold Co. dropped the stamps of their new mill for the first time on the 25th inst. The large compound condensing air compressor is working most satisfactorily, and the company is now in position to become a steady though small producer.

Work on the East Waverley tunnel was resumed the 1st of March.

The tribute work on the Lake View property is reported as doing well.

Tribute has also been let on the Windsor Junction property.

Cape Breton.

The quantity of coal shipped during January and February was very small in comparison with the summer months. Nearly all the mines are busy getting ready, either for summer work or banking coal on the surface to be in readiness for shipping.

Considerable discussion has been carried on with regard to the Hon. Mr. Fielding's action in advising his government to increase the royalty on coal from 7½ cents to 10 cents per ton on run of the mine coal. For the information of some of your readers, a few words on this question may be of interest.

Chap. 7, Mines and Minerals, contains the following on royalties: —

"Sec. 104.—Coal, nine cents and seven-tenths of a cent ($9\frac{7}{10}$) on every ton of two thousand two hundred and forty pounds of coal, except:—

(*a.*) Slack coal, that is, coal that shall have passed over a screen, the bars of which are not wider apart than ¾ of an inch.

(*b.*) Coal used by the workmen employed in and about the mine for domestic purposes; and

(*c.*) Coal used for mining operations in and about the mine from which such coal has been gotten."

Nearly all the collieries in Cape Breton agreed with the Department of Mines to pay on run of the mine coal a royalty of seven and one-half cents per ton instead of the nine and seven-tenths as specified on round coal. The difference being, as stated in the Act, round coal to pay nine and seven-tenths, and the small coal, which would go through the ¾ inch opening in the bars, would be free.

Run of the mine coal is coal just as it is taken from the miner, and on what they are paid, and contains all the round and slack. On this coal the owners have been paying seven and one-half cents per ton on all the coal shipped if as run of the mine, or if they shipped round coal and slack coal separately, as of course nearly all do, the round and slack were added and gave "run of the mine."

On the 18th of February, the agents and managers received a circular letter from the Department of Mines, stating that it was the intention of the Government to increase the royalty on run of the mine coal from seven and one-half cents per ton to ten cents per ton, and on screened coal, from nine and seven-tenths, to a figure in proportion to the advance on the run of mine, and that if the Bill became law that it would take effect from date.

In many cases contracts had been entered into before the receipt of this letter, and arrangements made with men for banking rates as, for instance, at Victoria mines, where the men received an advance of 3 cents per ton on last year's banking rates, the increased royalty (on 25,000 tons which they generally bank) came down hard.

The Ontario mine, at Big Glace Bay, has been sold to American parties, so says report; but it is early yet to communicate what they propose to do. As soon as possible the management will be interviewed by your correspondent and a full description of the property will be given. It has long been acknowledged to be one of the most desirable coal properties in the market, and the reported selling price is $80,000. Mr. Thomas Routledge, of Sydney, has had the selling of it, and his many friends will be glad of his success.

The fine open winter has been very favorable to all outside works, and also demonstrates that shipping at Little Glace Bay and Cove Bay, and the Port of Sydney, can be carried on for nearly every month of the year or until the drift ice in March comes on the coast.

Sydney and Louisburg Co.—Considerable work at the reserve slopes has been accomplished underground and banking commenced on the 15th of February, which was considered a remarkably early date. At the Emery mine of this company a compressed air plant of the Ingersoll-Sergeant pattern, was put in by the Ingersoll Rock Drill Co. of Canada, and several of their coal cutting machines are now at work in the mine and doing good work. The work of these machines are being watched with great interest both by men and masters as to the quantity of coal these machines can mine, and as to the relative cost in comparison between machine work and manual labor. It is rather early yet to form any conclusive decision as to their adaptibility for all kinds of coal, but it is a certainty that in the near future a large quantity of coal will be machine mined.

This company are also making extensive repairs to their shipping pier in Sydney, for the quick dispatch of steamers next year.

Victoria Mines.—An advance of three cents per ton has been granted to the miners on banking rates, and these mines are now working steadily in putting out their usual bank of coal, which comes up generally to the large quantity of 25,000 tons.

Considerable machinery is to be added in the machine shops in the way of lathes and other equipment.

International Mine.—The shipments from this colliery at Bridgeport have been, during the past two months of the year, nearly all by rail to supply the contract held by them of coal for the Cape Breton section of the Intercolonial railway, and in sending some coke to the steel works and glass factory at New Glasgow.

Extensive improvements are being carried out on the bank. The pit-head being raised 8 feet to lengthen the screens, which will allow of greater facilities for screening and cleaning the coal, a subject which has always received great attention at this mine.

The Murphy fan erected last year gives good satisfaction, and continues to run steadily.

Caledonia Mines.—Banking commenced here in the middle of February, and the levels are being driven and the bank head for the deeps lengthened and put in order.

Great preparations have been made to put the surface arrangements up to a most efficient standard. In the engine room a 20"x30" air compressor has just been placed on a concrete bed, pipes put down the pit to lead the compressed air to the coal cutting machines and underground pumps. A large cut stone boiler house and engine room are nearly completed. Two new cylindrical boilers are in place, and two 75 horse power tubular boilers are daily expected from the Jenckes Machine Co., Sherbrooke, Que., which will give them a heavy battery of boilers. A new iron smoke-stack has also been erected for increased draught. A new blacksmith forge, 100'x40' has been erected and fitted up for blacksmith's shop, car building and pick sharpening.

Gowrie Mines—Considerable coal was shipped during January and a less quantity in February, but coal was raised nearly every day to supply the twelve coke ovens which are kept constantly burning, the coke being stacked ready for shipment to Little Bay, Newfoundland, in the summer.

Some years ago a fault was encountered in the west level which cut out the coal. This winter a diamond drill was purchased by the company and a bore hole put down from the bottom of the level and the coal found and proven to be nearly 6 feet in thickness; this of course demonstrated that the Gowrie seam extended on the other side of this fault.

The wharf has almost been entirely built again under the able supervision of master wharf builder McAuley, and is in good order for an increased shipment of coal over and above last year. Banking has not yet commenced at this colliery, but the levels and deeps are being pushed ahead night and day, to be in readiness for the coming season's work.

Little Glace Bay.—At the Sterling pit, a new hoisting engine, made by Matheson & Co., New Glasgow, is being placed in position. This engine is of the most improved pattern and design, and is considered to be a fine piece of work. A new set of pumps are being put in place. In the pit, deeps are being driven to the dip of the shaft, and levels turned off. These deep inclines will open up a large area of coal on the harbor seam, and give an increased output to the mine.

They are also doing their usual harbor improvements, and the coming summer vessels entering the harbor will have a wider entrance by 25 feet than previous.

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Gardiner Mines.—Banking has been carried on since early in January, and considerable coal was sent away, both to the International pier for vessels and for local trade in Sydney and points east, and also to the Intercolonial railway. Though this coal has been but a short time on the market it has become quite a favourite and though it was late in the shipping season of 1891, when the Burchell Bros. were able to place any coal on the market, they succeeded in doing a good year's work, and are now pushing on their works for an increased output this year.

Quebec.

The Asbestos Club met in the club house at Black Lake, on 28th ult., Capt. Matthew Penhale in the chair. Among the new members elected were: the Hon. John Macintosh, M.P.P., Mr. W. B. Ives, M.P., and the recently-elected member for Megantic county—Mr. James King, M.P.P.

Arrangements are well in hand for the visit to the townships of the General Mining Association of the Province, in June. A successful meeting and an enjoyable outing are promised to all visiting the asbestos region on this occasion.

The electric transmission of power at the New Rockland slate quarry has been installed and gives satisfaction.

We have pleasure in announcing that the Jenckes Machine Co., of Sherbrooke, Que., has been appointed the sole representative and manufacturer of the diamond drills, patented and manufactured extensively in the United States by the American Diamond Rock Boring Co. of New York.

Ontario.

A meeting was held in Toronto the other day to organize a company having for its object the construction and operation of a blast furnace in that city. The proposal was received favorably. A deputation will wait upon the local government to ascertain if it will aid such an enterprise. The mayor of Toronto has expressed his views in favor of a grant of land favorable for a site free of taxation. This is a project well deserving attention at the hands of local capitalists, and we hope to hear soon that it has materialized.

Sudbury District.

The mining men of Sudbury are asking the Ontario Provincial Government for a subsidy of $3,000 to establish a nickel ore laboratory. They also ask a similar amount for four years to secure the services of an assayer, and advocate the establishment of smelters at Sudbury and Port Arthur. The requests are under consideration.

The Sudbury *Journal* says: The new manager of the Dominion Mineral Co'y, Mr. Cameron, arrived in town on the 15th inst, and will take up his residence at the mine in a day or two. Our reporter called on him at the Secretary's office, but was politely informed that as "he was not a Yankee, but a Scotchman, he declined to be interviewed." (We didn't intend to ask for an interest in the Co'y.) The offices of the company will also be removed from town to the Blezard Mine, and doubtless operations on an extensive scale will be commenced soon.

Messrs. DeMorest & Johnson, surveyors, of this place, are about to issue a most complete map of the Sudbury mining district, embracing the territory from Warren on the east to Straight Lake on the west and Massey on the Soo line. The plan will show each surveyed township, the lots patented and leased np to the 1st of March last, and also all mining locations on record in the Crown Lands Department. The size of the map will be 3½ by 5 feet, with sufficient blank space left to add, each year, any new survey and locations which will be made on the 1st of March in each year, at a small cost.

It is confidently expected that the Blezard will reopen under its new management and the fact that they have given a large contract for cord-wood to be delivered at the mine confirms this. Two new smelters will be put in during the spring—one by the Chicago Nickel Company, and the other by the Straight Lake Nickel Company, of which W. B. McMurrich, of Toronto, is president. The three new Bessemer furnaces of the Canadian Copper Company are now in full operation. By them the proportion of nickel in the matte is more than doubled as compared with that produced by the old furnaces.

There are also signs of activity in the vicinity of Webbwood, on the Sault branch of the C.P.R. While it is difficult to report accurately the extent of the sales of mining locations, yet there are sales being made at fair prices and good properties are changing hands.

Sudbury has already subscribed $5,000, or ten per cent. of the stock now offered for sale by the latest candidate for public support in the mining industry of this district, the Sudbury Customs Smelting Co., Ltd. This is the first venture of the kind in the nickel region, although no new thing elsewhere, and its progress will be watched throughout with interest.

Port Arthur District.

The mining school question was discussed at the last meeting of the Port Arthur Council, and when some of the members suggested that in giving $3,000 they would be paying rather dearly for their whistle, the Mayor brought them to time by saying that if Port Arthur didn't care for it, Fort William would probably take it. It was decided to submit a by-law to the people.

Two holes have been bored down fifty feet on Cape Mamaise property under the direction of Captain Thomas Tretheway, and the diamond drills have struck copper for the optionists so rich that the diamonds will cut no further.

Silver has been struck on location R 20, near the Badger.

The Y-One Company organized in Cleveland and Chicago is reported to be perfecting arrangements for an early and vigorous opening of this mine.

Further rich finds of silver are reported from the Port Arthur district.

Rat Portage.

Work on the L'Divir, Gold Creek and Gold Hill locations is being continued. Application has been made for a charter for incorporation of the Canadian Homestake Mining Company, Limited, to work the Yellow Girl Bay location. The provisional directors and those taking stock in the concern are local men of good standing and it is expected the company will be able to set to work without delay and show what can be done here.

The prospects of the reduction works are very promising. There are several gold prospects in the Lake of the Woods district now being developed and more to follow. Mr. Brent has made many improvements in the machinery of the mill since he took the management, and has greatly reduced the cost of operation. As it will be of interest to many of our readers, we give a list of prices charged for the reduction of silver ores:—

Value Ounces.	Percentage.	Charges.
20 —30	90	$8.00 per ton
30 —200	90	10.00 "
200 —1000	95	10.00 "
1000—1500	97	30.00 "
1500—2000	98	50.00 "

There is no doubt that the reduction works at Rat Portage will prove of great value to the miners in that district.

Rat portage has recently been "simply wild," over alleged great discoveries in the district, yielding most unusual amounts to the ton.

Hastings Co.

The Belleville *Intelligencer*, writing of profitable gold mining in Hastings county, says that Mr. F. R. Lingham had with him 70 ounces of gold, worth $15 per ounce, the product of 170 tons of ore taken from the Lingham gold mine, in Belmont. In addition to the bullion there was 916 pounds of concentrates, valued at $668, which would make the total yield of the 172 tons of ore $1,718, or $10 per ton. This is most satifactory, as the cost of mining and reducing the rock is rather less than $3 per ton, and the result will be a great impetus to gold mining in this section. The company is making preparations to put in a mill which will crush 100 tons per day. It will be operated by electricity, the power being obtained at Deer River and transmitted a distance of two miles. Their mill and process —Crawford's patent—is the only one which has treated the ores of this region with entire satisfaction. A practical miner, who is interested in a gold mine in Kaladar, having learned of the successful operation of the Crawford process of reduction of the gold-bearing rock of the Lingham mine, arranged with the managers of that concern for a test of 11 tons from his location. The weather and the roads, which were alike bad, prevented the delivery of more than seven tons at the mill, but this was put through and the result proved highly satisfactory, showing that the mine can be made to yield a handsome profit.

Petrolia Oil District.

The course of crude prices, while gradually tending downward, has not been decisively indicative of a permanent decline. Business has continued very dull, and few features of interest have transpired. The almost complete absence of speculative interest on the part of any outside operators combine to be a feature of discouragement, and the purchase of the raw material is in the hands of a few manufacturers. The price of refined oil keeps very low, and the chances are that the fall trade for 1892 will still witness the keenest kind of competition between manufacturers of illuminating oil. The drillers are kept busy all over the oil territory, both Petrolia and Oil Springs, and any amount of four and five barrel wells are reported, but as there are quite a few neophytes in the business we must cut the product of their wells down somewhat. There has hardly ever been a well drilled in the Petrolia oil region but what has been over estimated. Once in a while we hear of a producer who will underestimate rather than the opposite, but the great majority will incline to the former. The person, however, to become most seriously affected is he who happens only occasionally to gaze upon the outpouring of a well. As a rule his imagination becomes exercised and he spreads himself all over the territory without hope of limitation, and a well that perhaps is pumping about a half a barrel a day is put down in his estimation as going about two or three barrels.

Manitoba and North-West Territories.

The number of applications for coal mining lands during last year was 107, and 11 of the applicants were given the privilege of purchasing, within a specified time, the location for which they applied, and 18 of the applicants were given permission to prospect thereon. Five of them bought the land applied for, or a portion thereof, and one of the applicants being a homesteader was permitted to mine coal by paying 5 per cent. royalty on the coal mined.

The revenue for the year derived from the sale of coal lands was $8,898.75, being an increase of $7,236.25 over the previous year. The total area of coal lands sold up to date is 13,079.76 acres, and the total amount received therefor, $135,070.07.

In the Annual Report of the Department of the Interior the following reference is made to the regulations in force governing the disposal of minerals on Dominion lands under its control:—

"The arrangement between the Provincial and Dominion Governments, that all minerals, with the exception of coal, on Dominion lands in the Province of British Columbia, are to be administered under the mining laws of the Province, is still in force. The only amendments which have been made to the Mining Regulations since my last report are those set forth in the Order in Council of the 18th of December last, by which an applicant for a petroleum location, who has otherwise complied with the requirements of the regulations, may be able to obtain an entry for a location upon his making affidavit that from indications he verily believes that petroleum exists on the location applied for—the location, however, not to be sold to the applicant until a period of five years from the date of entry prescribed by the regulations, unless he can, in addition to compliance with the requirements aforesaid, furnish proof to the satisfaction of the Minister of the Interior that he has at least one oil well in operation thereon, and is producing therefrom petroleum in paying quantities; and provided, further, that if at the end of five years from the date when the date the applicant obtains entry he cannot furnish such proof, the entry shall be cancelled and the rights and privileges of the person obtaining the entry shall thereupon cease and determine in respect of such location. The regulations, before they were thus amended, provided that no mining location or mining claim should be granted until actual discovery had been made of the mineral applied for within the limits of the location or claim. This being the law, it prevented a large number of applicants from receiving entry for petroleum for which they had applied, because they were not able to make the requisite affidavit of actual discovery; it was thought that this might operate to retard the development of lands supposed to contain petroleum. Since the regulations have been amended, as explained, the Agent of Dominion Lands at Lethbridge has granted eighty-four entries for petroleum locations in townships 1, 2, 3 and 4, ranges 29 and 30, west of the 4th meridian."

The Canadian North-West Coal company has struck a rich four foot seam of coal in the tunnel at Canmore.

Mr. Cochrane, manager of the Canmore mines sent about 100 tons of the semi-anthracite smokeless coal from Canmore aboard the Empress of China on her last tirp to Vancouver. The coal will be tested, and if satisfactory Captain Tillett will strongly recommend the C.P.R. Steamship company to adopt it altogether on the Pacific liners. Mr. Cochrane is pushing the merits of the Canmore coal before the greatest users with a view to extending trade. Some of it was tried on the ships of the Pacific squadron and proved satisfactory.

During the year about 170 applications were filed with the agent of Dominion lands at Lethbridge for petroleum locations situated in townships 1, 2, 3 and 4, ranges 29 and 30, west of the 4th meridian, and in townships 1 and 2, range 1, west of the 5th meridian, in the district of Alberta; but as the applicants could not furnish affidavits in accordance with the requirements of the mining regulations that they had discovered petroleum on the locations applied for, entry could not then be granted to them.

As it was thought that this provision of the regulations might operate to retard the development of lands supposed to contain petroleum, it was amended by an Order in Council of the 18th of December, 1890, so that now an applicant who has otherwise complied with the requirements of the regulations is able to obtain an entry for a location upon his making affidavit that from indications he verily believes that petroleum exists on the location applied for. The location, however, not to be sold to the applicant within the period of five years from the date of entry prescribed by the regulations, unless he can, in addition to compliance with the requirements aforesaid, furnish proof to the satisfaction of the Minister of the Interior that he has at least one oil well in operation thereon, and is producing therefrom petroleum in paying quantities; provided further, that if at the end of five years from the date when the applicant obtains entry he cannot furnish such proof, the entry shall be cancelled, and the rights and privileges of the person obtaining the entry shall thereupon cease and determine in respect of such location.

The majority of the applicants above referred to will now be in a position to obtain entries for the locations applied for.

The Alberta Railway and Coal Company has now an output of 1,000 tons a day. Of this Canadian customers take about 300 or 400 tons; the balance goes to the various business and mining centres of Montana. The company is still sinking shafts, and it is anticipated that by the first of July it will have increased its output to 2,000 tons a day, and will have a market for that quantity if it can be forwarded.

At Canmore the Canada North-West Coal and Lumber Syndicate is opening up what was known as the Brinkerhoff claim. The output from this mine is about 80 tons per diem, but a tunnel is being constructed which, when completed, will intersect four seams of coal, enabling them all to be worked, so that in the future the output may be indefinitely increased. The seams intersected are of various qualities, so that a variety of requirements in coal can be met.

The mines at Cochrane are not now being operated by the Canada North-West Coal and Lumber Syndicate, which seems to have devoted the whole of its energies to the development of the property at Canmore. The company, it is stated, intends shortly to open coking ovens, this coal being particularly valuable for the production of both gas and coke.

British Columbia.

Cariboo District.

Mr. Bowron, Gold Commissioner, reports the gold yield from the district during last year as follows:—

Barkerville division	$ 63,450
Lightning Creek	33,850
Quesnelle Mouth	30,600
Keithley Creek	57,100
Estimated product from 15th Nov. to 31st Dec	10,000
Total	$195,000

The Black Jack Quartz Co. has sunk to the depth of 125 feet, and after running 75 feet of a drive through very hard rock, finally struck the ledge again. The vein is about five feet in width. Having proved the continuance of the ledge downwards the company will, this spring, start on the 70 foot level to take out and work the ore in their small mill, and have the sulphurets worked on the Government test works.

Thirty-one mica claims were located near the Têtê Juan Cache, in this district, by a Mr. Bennett and party of Kamloops.

The Waverley Hydraulic Co. of Grouse Creek had a gratifying season, the claims having yielded about twice the amount of any previous year, which gives evidence that the company will soon be in the pay gravel they have so long struggled to reach.

Mr. St. Laurent, of Quesnelle, reports the discovery this season of gold in paying quantities, by a party of Chinese miners, on a large creek, a tributary of Quesnelle River, which flows into that stream some 20 miles from its mouth on the north side. The creek is from 20 to 30 miles in length, and five Chinese, working about five miles from its mouth, took out about $2,000 during the season.

On the South Fork of the Quesnelle River, there are two companies—the Victoria Hydraulic Mining company and the South Fork Hydraulic Mining company—which, during the past season, have been pushing their works ahead as fast as it was possible for them to do, in the way of digging ditches and other work necessary to the opening up of their hydraulic mines, and, owing to the nature of the country they are operating in, both companies have certainly done a great deal of work for the season. The Victoria company has now something over seven miles of ditch, five feet wide on the bottom, seven feet wide on top, by twenty-four inches deep. This ditch brings the water from Spanish Lake upon the ground they are going to work, on Coquet Creek, at the lower end of Quesnelle Lake. This company has other locations, which they intend opening as soon as it is possible to get the necessary work done. During the season, they have employed, upon an average, a force of ten whites and fifty Chinese. Their works are well advanced, and early next season they expect to be in full operation. The South Fork company have about five miles of their ditch completed. Their ditch is four feet wide in the bottom, six feet on the top, by twenty-two inches deep. This part of their ditch is through a very rough country, a great deal of blasting and rock cutting having been done to avoid fluming. They have also completed a large reservoir, which will enable them to use their hydraulic pipe ten hours out of the twenty-four just as soon as they can get ready. This they expect to be able to do during the coming season. This company during the season has employed, upon an average, ten whites and thirty-five Chinese, and will continue to push their work as fast as possible until they get their mine opened. Both these companies will have an ample supply of water during the whole mining season when their ditches are completed and in working order.

Quesnelle is very active just now, as the machinery for the Victoria Hydraulic Co. is being put up. The works are expected to be thoroughly fitted up in the fore part of the summer.

A hydraulic company, composed of English capitalists, will commence the opening up of William's Creek early in the spring. This company has been promoted by Mr. J. D. Whittier. The ground on William's Creek, from the Ballerat claim to a point above Barkerville, has been acquired, altogether a distance of about a mile. A space will be excavated at the lower end, where a hydraulic elevator will be placed which will carry the tailings to the surface. where they will be taken off in the flume.

Slocan Lake District.

Sixty-four mineral claims have been recorded at Nelson since the 1st of January—60 of them in January. Most of the claims are situate in the Slocan Lake section of the division.

The Kaslo-Kootenay Land and Improvement Co. have entered into an agreement with the North-Western Sampling and Milling Co. for the erection of a sampling works on the water front of Kaslo City. The works will cost not less than $15,000.

Through the enterprise of the Kaslo City people a trail about 17 miles in length has been made from Kaslo, on Kootenay Lake, to Fish and Bear Lakes, about 5 or 6 miles from the Noble Five, and just as soon as possible this trail will be continued right up to the mines. It will afford the most feasible route for shipping all the ore and mineral from that section of the country out to Kootenay Lake, and from Kaslo there is water communication with Bonner's Ferry, where the Great Northern can be taken east or west, or to Nelson, where the C.P.R. is accessible. From Kaslo the ore can also be shipped very conveniently to the new smelter at Pilot Bay. This will make Kaslo the distributing point for all the mines within the area of some 25 miles, and there are now within that radius from 75 to 100 locations.

The work on the Montezuma claim, 6 miles from Kaslo, has developed into one of the most wonderful prospects in the Kootenay country. This claim is lower down the mountains than any other, and it is the only one yet ready for working this year. Most of the prospects are on the higher levels; they are covered thickly with snow, and though all the snow has gone from Kaslo it will be impossible to go out to the hills for another month.

Illecillewaet District.

The little village which is the home of most of the prospectors who have been the pioneers of this camp, is situated on the main line of the Canadian Pacific Railway, about 400 miles east of Vancouver, and 2,400 west of Montreal. Most of the surrounding mines are situated about 3,000 feet from the railway track; but when one remembers that in only one case is there a claim further away than 20 miles the difficulty accruing from the long climb is greatly modified by the nearness to shipping facilities, and in cases like the Lanark, etc., ore will be brought to the track and sampling works below by means of an aerial tramway, at an expenditure of not more than a few cents per ton. For many years this mining centre has been a silver lead producer of no inconsiderable amount; but during the summer and fall of last year renewed vigor was thrown into the camp by the discovery of the now well known Fish Creek lode. In consequence of this rich find many prospectors were led to make tracks for the locality, and gradually the vein was traced for four miles, with an average width of four feet. The principal work in hand, however, in the district is the development of the Lanark mine, where there is a large amount of ore being taken out of the 400-foot level. This level was run in to tap the vein discovered above, which resulted successfully. With an average assay of about 58 oz. of silver per ton, and lead 40 per cent., one can easily calculate the profits in working such a body of ore as has already been found. The width of the main vein is 27 feet. This has been traced from the surface and intersected at a depth of 96 feet, showing throughout good concentrating ore, the extent of which is unlimited, owing to the fact that it extends below the cross-cut already made.

The Maple Leaf is a valuable property carrying very high grade galena, and is an extension of the Lanark. A good deal of work has been done, and with the present showing the probabilities are that this, with other claims, will be developed shortly by English capital.

Nanaimo.

The foreign shipments of coal for February from the New Vancouver Company was 21,588 tons; Wellington, 11,886; Union, 8,660, and East Wellington, 2,369.

A meeting of the Miners' and Mine Laborers' Protective Association will be held soon as possible, to consider the advisability of cabling the different workings in the mines. A few of the miners here have always been anxious to make some changes around the works. These changes very frequently do more harm than good. It is believed this cabling will bring more expense on the companies without benefit to the miners. Some of the "bloods" here are looking for new changes and are anxious to dictate to both men and managers. A large number of men have been idle for the past three months, and a great many of them might be working but for such men as are turning unionism into a curse instead of a blessing.

Since the Wellington strike began on May 17th, 1890, the Miners' and Mine Laborers' Protective Association have expended the sum of $84,033 in support of those men in their struggle to win the strike.

The wires for the electric tramway in No. 1 shaft, N. V. C. Co., are now all strung, and directly the motors arrive the cars will be worked by electricity, causing a great saving of time and materially increasing the daily output.

Mr. Haggart, who has been sinking the shaft for the Wellington collieries near Departure Bay, has been compelled to stop sinking for the present, owing to the inrush of water being in excess of the ability of the machinery to handle. Larger machinery will be brought from the No. 4 shaft, and a permanent pit head and hoisting frame will be erected. It will be nearly three months before the work of sinking will be re-commenced. This shaft is situated about mid-way between the Wellington mines and salt water, just at the Big Bend in the Wellington colliery railway.

The long-wall system has been adopted at the Northfield mine.

A coal company has been formed in South Westminster by several well known men interested in property south of the river. Boring for coal will be started immediately in various parts of the district, and the drilling as soon as possible.

Letters just received from Nicola Valley contain the good news that Mr. John Corbett has succeeded in striking a vein of splendid coal on Mrs. A. A. Green's property, the seam being six feet three inches in thickness and of uniform excellence. The strike was made only about half a mile from the old shaft, from which the neighborhood has been supplied with fuel for months, and as the coal is of a quality seldom met with, and there appears to be plenty of it, the development of the mine will, no doubt, be proceeded with as expeditiously as possible. The land through which the seam extends is part of 2,100 acres belonging to Mrs. A. A. Green, and has long been known to be rich in mineral. It is convenient to rail, and the mine can, and no doubt will, be worked with advantage.

Ainsworth District.

The *Miner* says: Many are beginning to believe that the Krao is sure to be one of the best mines in the Kootenay Lake country, basing their faith on the present appearance of that property. It is claimed there is ore everywhere work has been done. The south drift is now in 80 feet, and the north 55 feet. The Neosho is also showing up finely, the drift being in 17 feet.

Nelson District.

Work has been commenced on the Silver Queen, the claim recently sold to a Montreal company. John Robinson, of the Grizzly, will act as superintendent until spring.

The Silver King tunnel is now in over 800 feet. A vein of ore, nearly a foot wide, has been struck on the south side, the ore being similar to that in the big ore body on the north of and parallel with the tunnel. This is said to indicate that this ground contains one of the largest deposits of ore on Toad Mountain.

The smelter is getting on nicely. There are now 35 men at work, and the dock and approach on the lake side of the peninsula are just about completed. Everything will be ready for buying ore about the 1st of July.

The south drift on the Dandy is in 50 feet from the cross-cut tunnel, and its face is in ore of entirely different character from that first encountered. The gangue is quartz carrying grey copper, and is of the same character as that found in the Silver King. All the indications are that a good-sized ore body is close at hand.

A Trail Creek correspondent writes: "Of the claims bonded lately, the following can be mentioned: The War Eagle, the Virginia, and two-thirds of the Iron Mask, bond $14,000, cash $1,000; one-third of the Iron Mask bond $4,000; cash, $400; the Cliff, bond $10,000; cash, $1,000; the St. Elmo, bond $6,500; cash, $650. A number of lots in Trail have also changed hands. A pre-emption has been taken up near the Le Roi mine. There is also a little stir at the Pend d'Orelle River; several applications to lease large tracts of abandoned placer ground have been sent in. Altogether, things down here are beginning to run very smoothly."

Mr. D. C. Corbin, of Spokane, while in Washington, had an interview with Acting Secretary Spaulding, relative to the importation of ore from British Columbia. The smelters being at Spokane, it is necessary that importers give bond for the payment of duty. The Treasury Department has decided to send Major Ruth to Little Dallas, where the ore is unloaded.

Frank H. Doty, of the Doty Engine Works, Toronto, has completed a contract with Captain Tibbetts, of the Kaslo-Slocan company, for the engines and machinery of

a steamer to ply on the Columbia River into British Columbia.

Mr. F. S. Barnard, M.P., who returned recently from Spokane, says that his visit to that busy city was for the purpose of discussing with others interested the affairs of the Columbia and Kootenay Steam Navigation Co. The first steamer on the route this season is expected to leave Little Dallas on the 15th of March—a little earlier than usual. There will be daily communication, with four steamers running, between Spokane and Nelson before the 1st of April.

CANADIAN COMPANIES.

The Canadian Homestake Mining Co. of Ontario, (Ltd.)—Will apply for incorporation with the object of dealing in, buying and selling mineral properties and mines, and operating the same, and smelting ores, in the County of Algoma. Head office, at the Village of Rat Portage. Capital, $1,250,000, in 250,000 shares of $5 each. Applicants are: David L. Mather, lumberman; and Robert A. Mather, lumberman; both of the Village of Keewatin, in the District of Rainy River; William Travers Creighton, lumberman; James M. Savage, lumberman, and Jeff Hildreth, miner, all of the Village of Rat Portage.

The Cayuga Natural Gas Co., (Ltd.)—Gives notice of application for a charter to supply natural gas for heating and lighting purposes in and around the town of Cayuga, Ontario. The said town will be the chief place of business. Capital is $20,000 in 100 shares of $200 each. Those applying are as follows: David Thompson, physician; Joseph Johnson, clergyman; L. L. Barber, merchant; Alex. Mitchell, merchant; John A. Hashal, hotel-keeper; John A. Murphy, law student; Edward C. Campbell, editor; George R. Powell, jeweller; all of the town of Cayuga, in the County of Haldimand and John Carmody, contractor, Dunnville.

The Canadian Mineral Wool Co., (Ltd.)—Desires incorporation under the Dominion Statutes for the purpose of acquiring the premises, patents, stock, machinery, etc., of Messrs. Gast & Co., Toronto, in dealing in mineral wool and asbestos, the manufacture and sale of mineral wool, asbestos and other insulating material; and the manufacture of improved pipe and boiler covering under patent number 23,345, known as "Lamkin's Patent." Head office, Toronto. Capital stock, $40,000, in 400 shares of $100 each. The applicants are James Black Perry, Toronto, John Edward Armstrong, Taunton, Mass.; Frank Joseph Gast, manufacturer, Toronto; Euphemia Perry, wife of the said James Black Perry, and James Munro Sinclair, accountant, Toronto.

Bell's Asbestos Co., (Ltd.)—This company held its ordinary general meeting at the Cannon-street, Hotel, E.C., last month, under the presidency of Mr. John Bell, who, in moving the adoption of the report and accounts, reminded the shareholders that at the last meeting he told them the directors had made very important forward sales of crude asbestos. He had now to state that from these sales they would derive a larger profit than had ever been previously obtained from their, or any, asbestos mine. In November last the board advised the shareholders that they thought it desirable to join in the united action of the principal asbestos mines in Canada to restrict the output of material by closing the mines during the winter months to prevent over-production. Nothing had interfered with their ordinary good fortune, no failure of production had occurred, but it got abroad that money was to be made out of asbestos mining, and a stimulus was thus given to the opening of other mines. A consiberable shrinkage subsequently took place in the consumption of the manufactured article, both in this country and on the Continent. Then came indications of a glut in the raw material, and the principal mine owners of Canada approached them on the subject of again restricting the output and their company came to the conclusion that they had better join in the movement. They had averted the embarrassing state of the market with regard to the produce with which they had to deal. With regard to the trade and manufacture of asbestos, there was a decline during the early part of the year, but, later on, owing to the perseverance with which the directors and managers of the company continued to give the best value for money that anybody in the trade could give, the tide had turned, and a greatly improved state of trade had been steadily maintained. They had, however, been content with much lower prices than in previous years. Times were depressed and they had to meet their customers as well as to face competition. During the past year they had sold in bulk more asbestos than they had ever sold before. (Applause.) The reports and accounts were adopted unanimously. A resolution was afterwards passed sanctioning the payment of 7s. 6d. per share, making with the interim dividend a total distribution of 10 per cent. for the year.

Canadian Phosphate Company.—The third annual meeting of this company was held in London during the month, Mr. E. Packard, chairman of the company, presiding. The following is an excerpt from the directors' report submitted:—"It is with extreme regret that your directors have to report that their favorable anticipations have not been realized. The quantity of phosphate raised during the first two years' working, now under review, was 7,206 tons of uncobbed ore, and during the second 2,621 tons up to August 29th, 1891, when the mining operations were discontinued. The actual cost of bringing this ore to bank was about the same as in previous years, but the amount realized by the sales was very materially less per ton than former averages. The reasons of this were two-fold. (1) Owing to the admixture of deleterious elements with the phosphate in some of the pits, and the soft nature of the ore in others, the quantity of first class quality was very much less than the ordinary proportion to the total quantity produced. (2) Owing principally to the competition of the phosphate from the Somme deposits, the prices obtained for second and third-class qualities in Europe fell to a point considerably below cost of production. Judging from the weekly reports received, and basing their calculations upon the result of former years, your directors were under the impression at the time when the resolution was passed to declare an interim dividend, that the mines were being worked at a substantial profit. It was only at the close of the season, subsequent to the payment of the dividend, that it transpired that not only was the quantity of 80 per cent. quality far short of the estimates made, but that the quality of the second grade was in most instances below the minimum percentage guaranteed, which caused the buyers to make serious deductions from the price at which the ore had been sold. Work was continued at the mines until the end of August, 1891, the weekly reports from the Crown Hill mines being particularly favorable, but the bad results obtained from the old mines necessitated the stoppage of work in the meantime. The influence of the new discoveries and heavy shipments of high-grade phosphate from Florida has been very prejudicial to the interests of the Canadian phosphate mining industry, but prices will no doubt improve before long. Owing to the general outlook at the Crown Hill mines, your directors anticipate that it will not be long before satisfactory arrangements can be entered into for the recommencement of work on this part of the property, either by royalty or by contract. In the meantime a lumber contract has been entered into, and logs are being cut and hauled to the river's bank. The mill at Buckingham is continuing to grind the low grade, contracts for the sale of which have been already made for delivery to western points."

Thunder Hill Mining Co.—At a meeting held on 25th ulto., the following directors were appointed for the year: Major J. Nicholls, Foster Macquden, D. R. Kerr, W. F. Bullem, W. T. Taylor, F. T. Child, J. S. Bowker, all of Victoria, B.C.; J. H. Twigg, J. M. Browning, of Vancouver. It was decided to increase the capital to $500,000.

The Northwestern Sampling and Milling Co., (Ltd)., has been incorporated with a capital of $100,000 shares. The object of the company is to develop mines, acquire mining properties, and the reduction and refining of ores. The headquarters are at Nelson. Ernest Arnoldi has become manager. He will have charge of the new works at Nelson.

The Southwestern Coal Co. has been organized in New Westminster, and a committee has been appointed. Arrangements are to be made with the property owners on the south side of the Fraser River to go on any piece of property and drill for coal under certain conditions.

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Applications for Licenses or Leases are receivable at the office of the Commissioner of public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenscs are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

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All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are : Copper, four cents on every unit ; Lead, two cents upon every unit ; Iron, five cents on every ton ; Tin and Precious Stones ; five per cent. ; Coal, 7½ cents on every ton sold.

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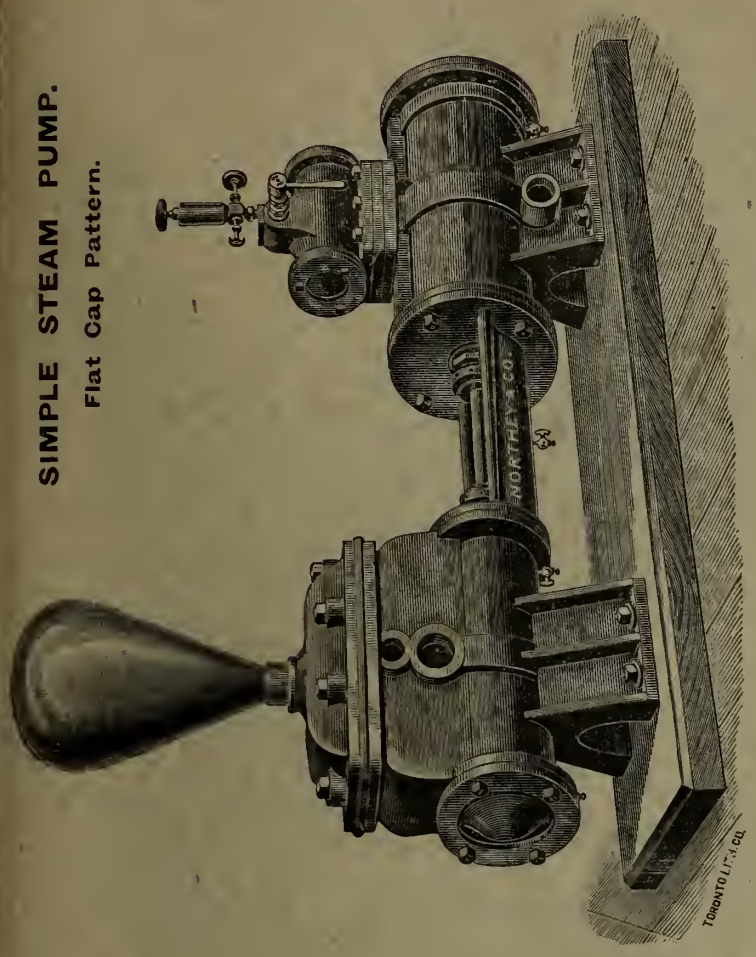

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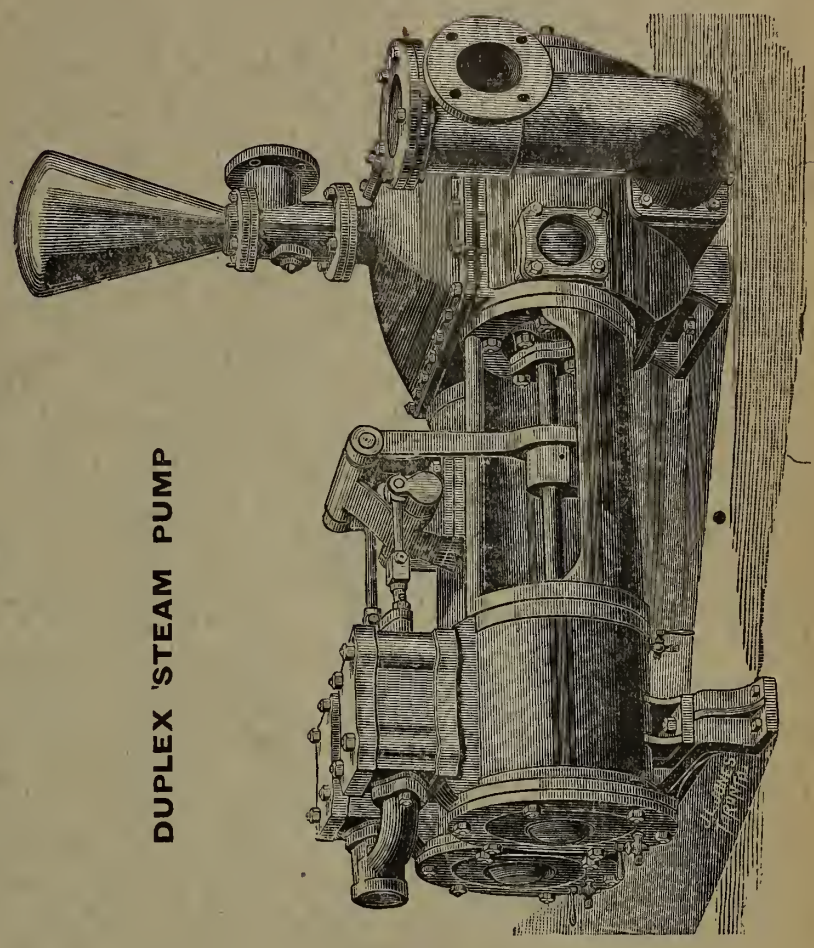

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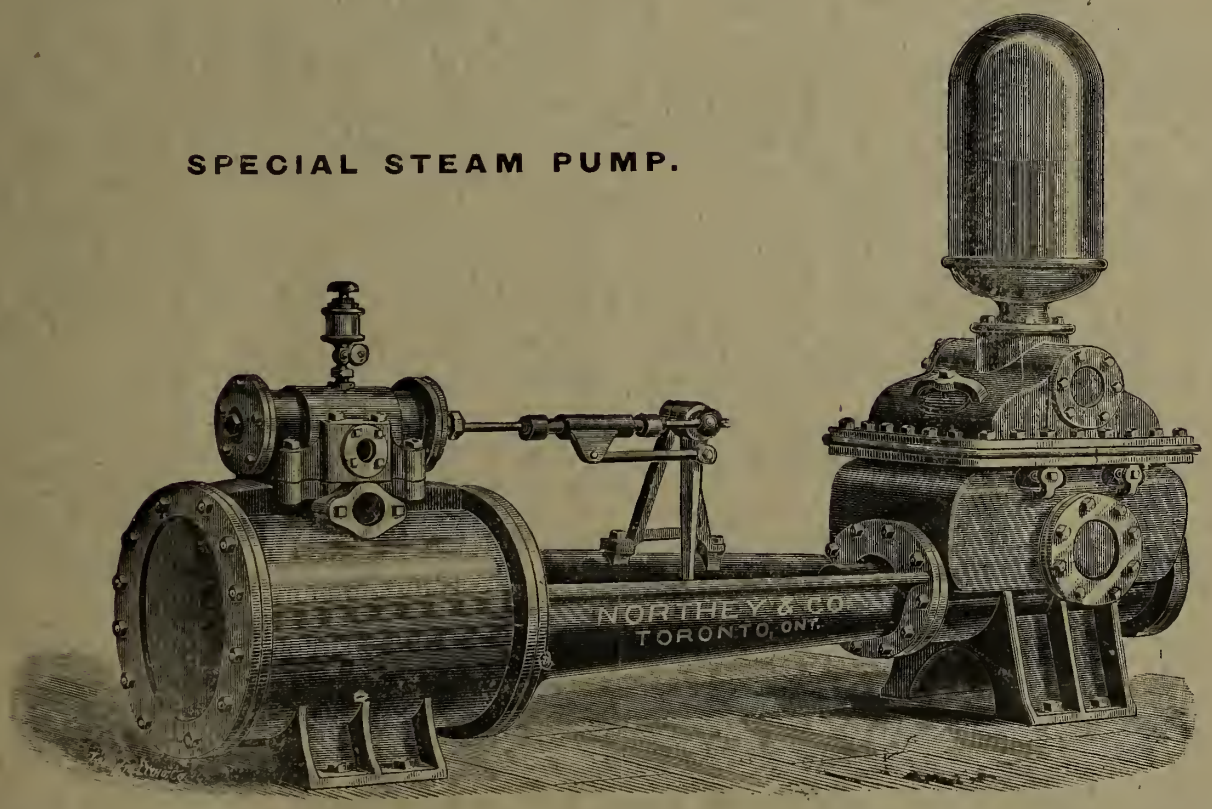

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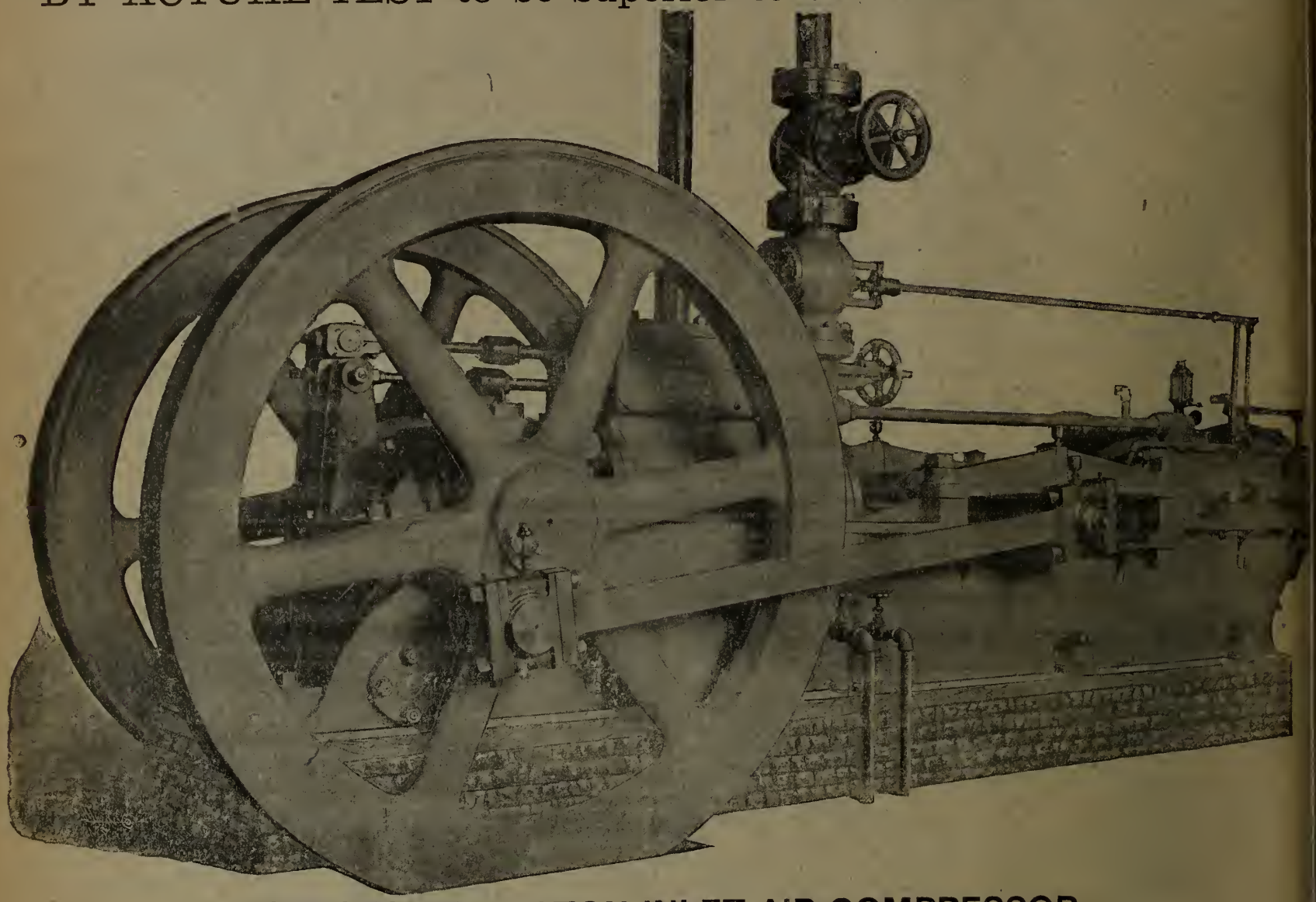

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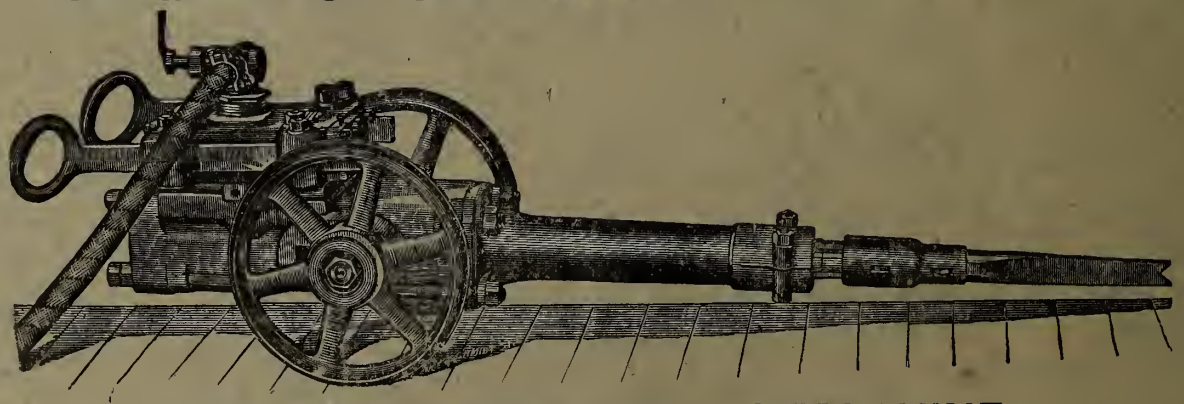

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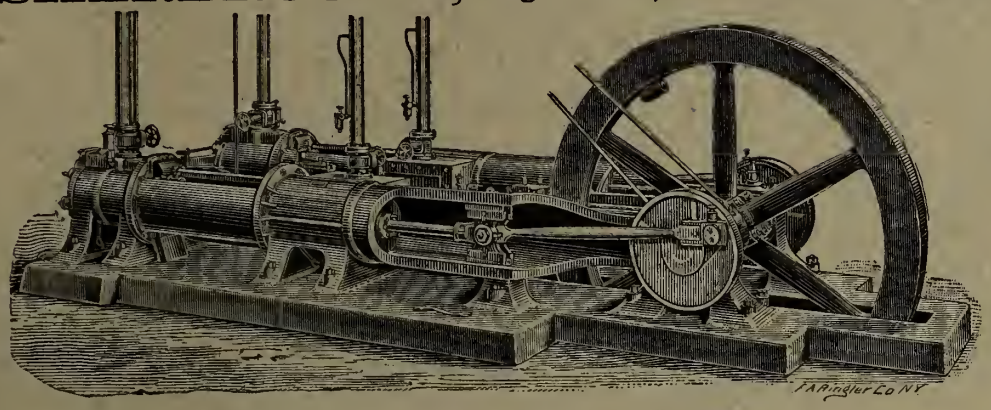

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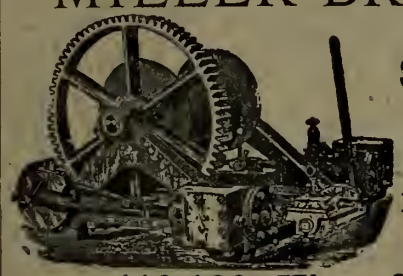

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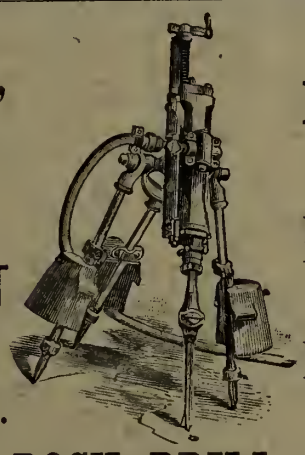

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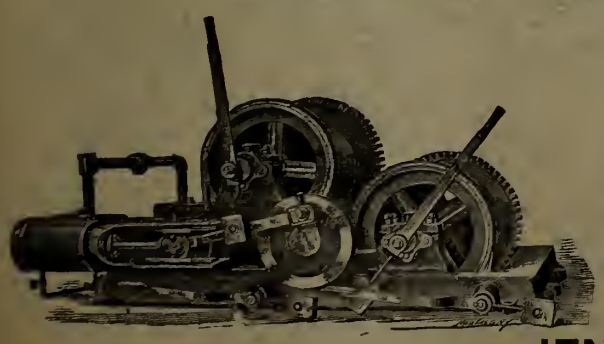

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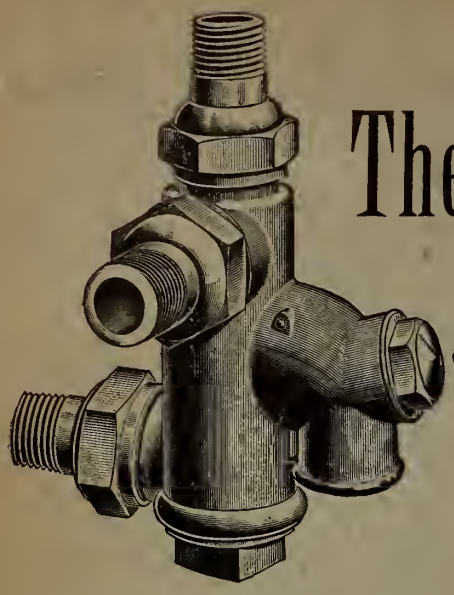

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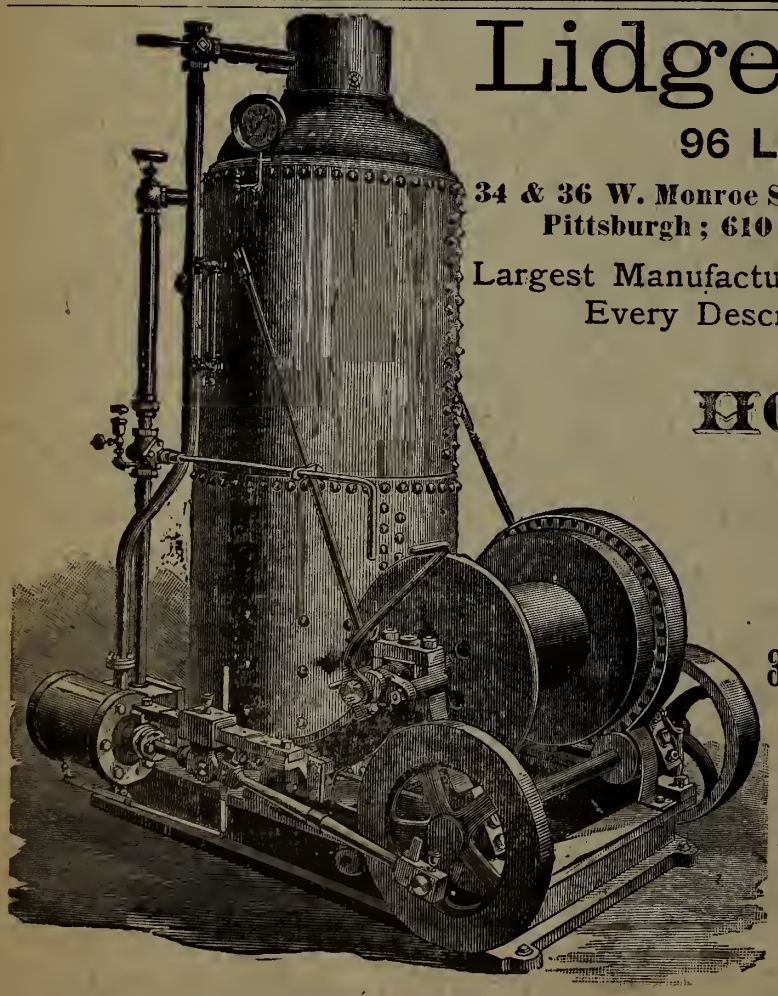

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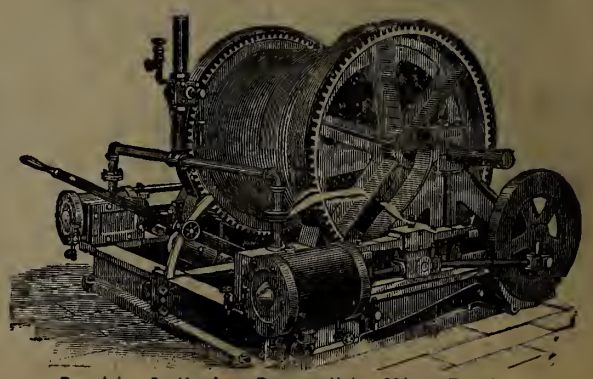

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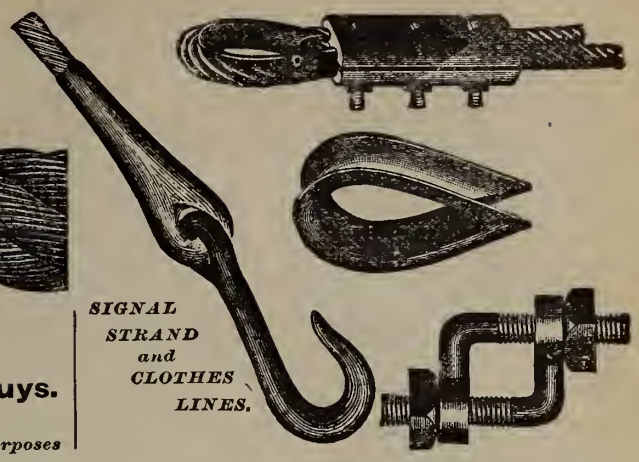

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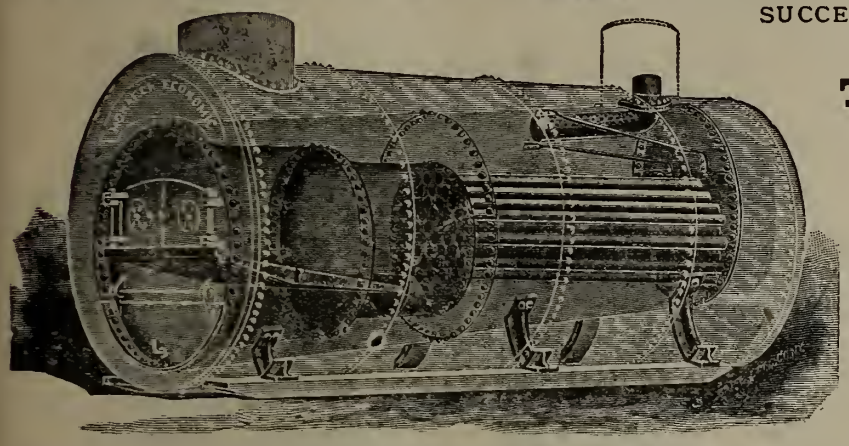

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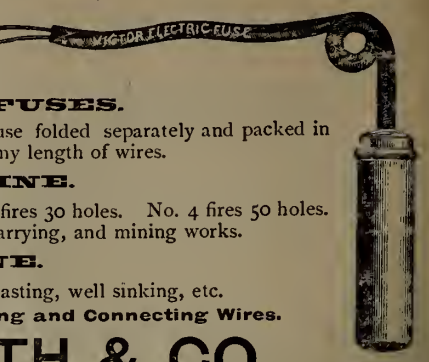

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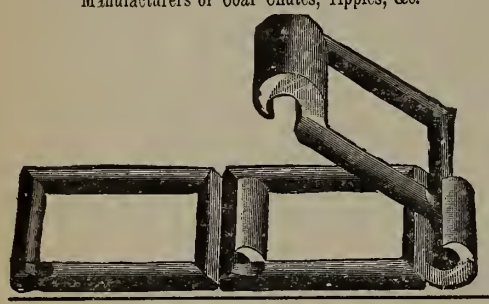

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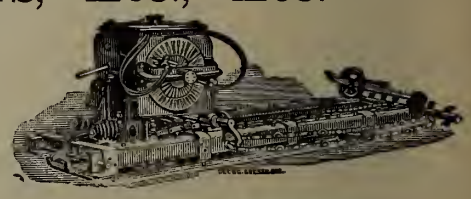

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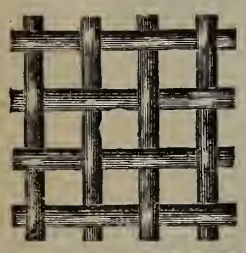

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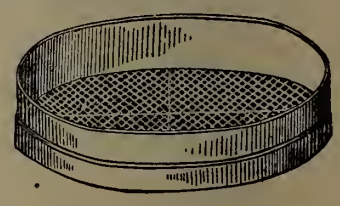

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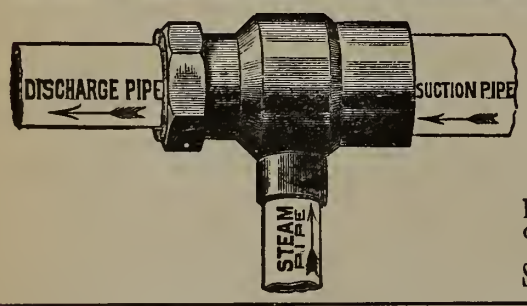

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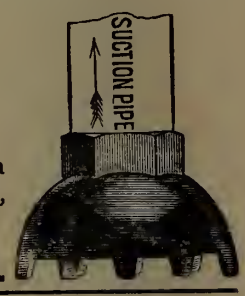

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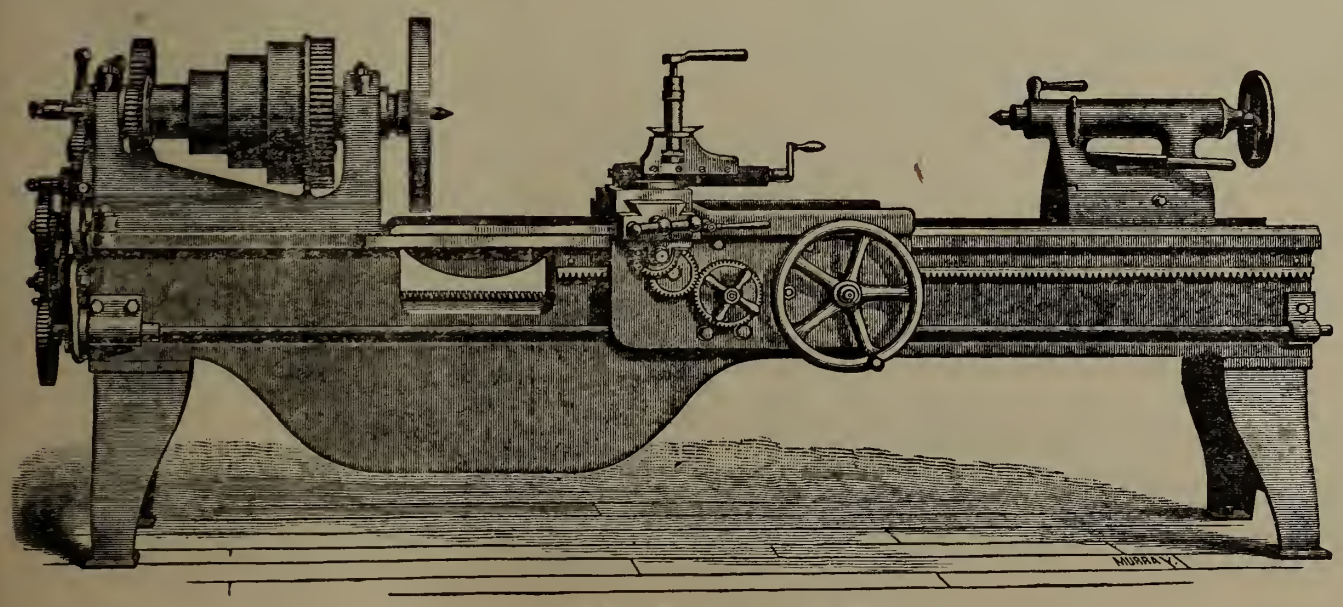

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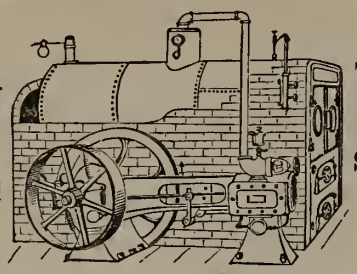

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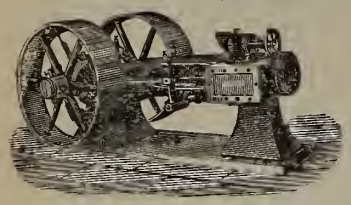

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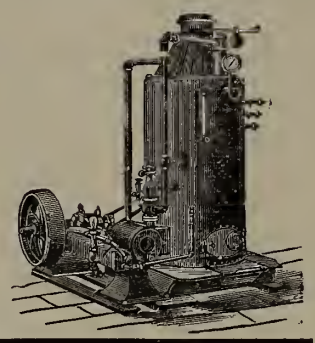

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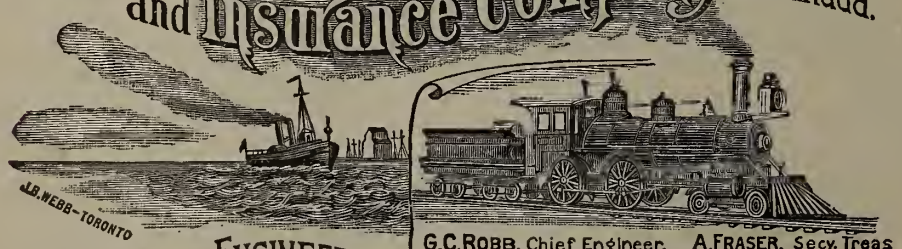

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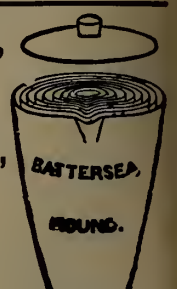

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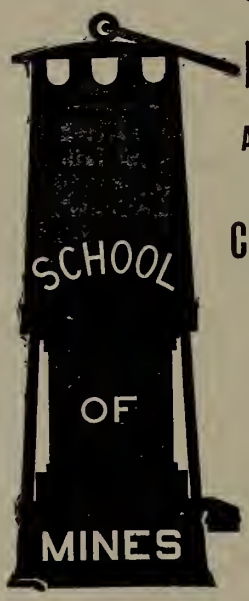

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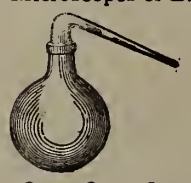

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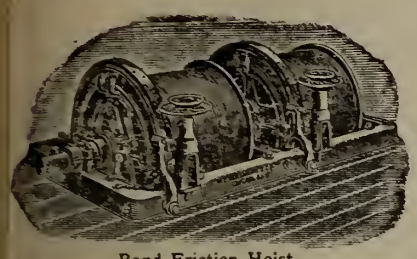

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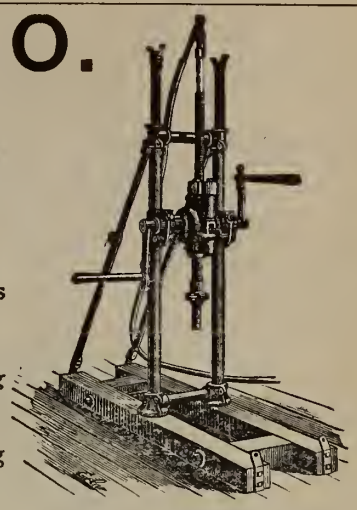

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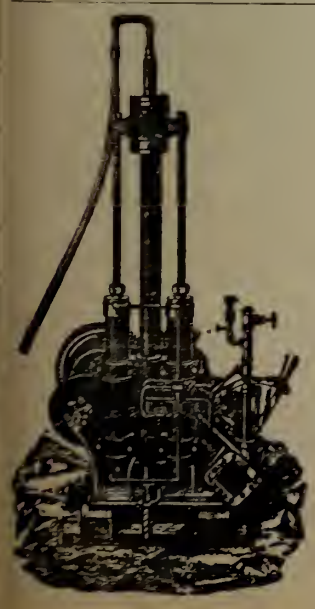

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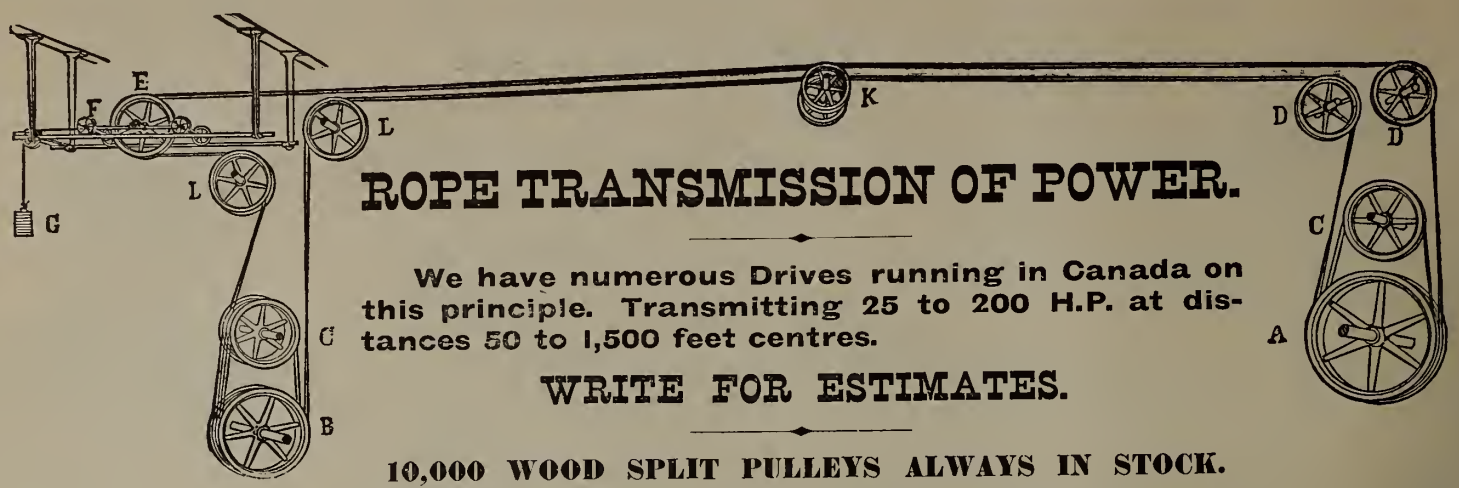

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The Diamond Drill brings to the surface a **solid core** of rock and mineral to any depth, showing with **perfect accuracy** the nature, quality and extent of the ore-bearing strata, and with great **saving in time and expense** over any other method.

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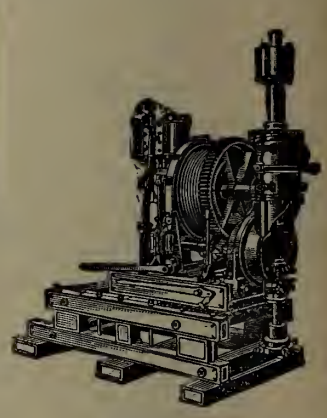

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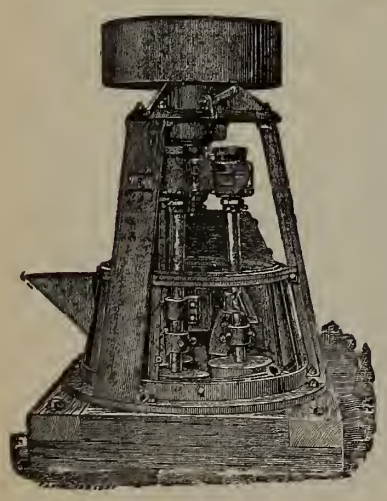
Capacity—2,000 ft. depth.
Removes 1¾ inches solid core.



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No Tailings, No Re-grinding, No Slime. Capacity Hard Quartz 2 a 3. Phosphates, Cements, &c., 3 a 4 tons per hour. Only 15 to 20 H. P. required. Weight of each Mill 5,600 Pounds.

AMERICAN ORE MACHINERY COMPANY,
No. 1 Broadway, New York, U.S.A.

R. T. ROUTH, *Canada Sales Agent,*
Corn Exchange, Montreal.

(Copy.)
Wilmington N.C., Sept., 21st., 1891.
American Ore Machinery Co.,
No. 1 Broadway, New York.

Gentlemen,—In answer to your favor of recent date, I would say that after over EIGHT MONTHS' experience with the "Narod Mill" under varying conditions, I have never regretted the purchase of the one we have. I think the "Narod" is by far the best and most economical Phosphate Grinder on the market. The Mill does not take 20 horse power to drive it, runs smooth without heating, and has NEVER BROKEN DOWN. The product varies a little as to the kind of Phosphate ground, but I have not known it to do less than 3½ tons per hour, and under favorable conditions the Mill grinds 4 tons per hour and will continue indefinitely.

Pieces of Iron, &c., getting in with crude material do not bother it, as is the case with most other Mills, and this I consider one of its strongest points. I THINK $100 WOULD MORE THAN COVER THE REPAIRS FOR A YEAR.

Yours truly, C. E. BORDEN,
Supt. Navassa Guana Co.

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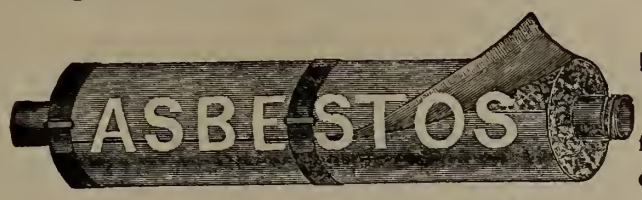

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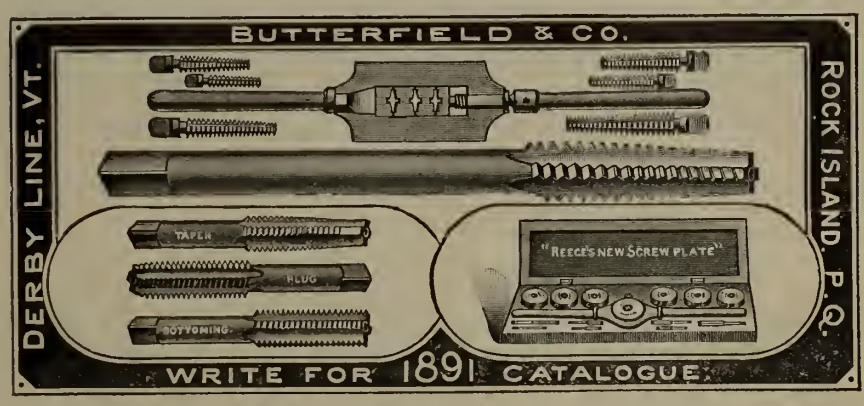

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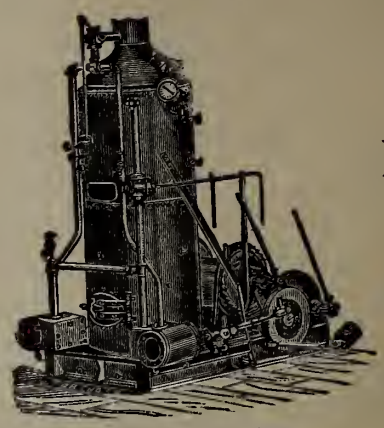

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Horse-Power Hoisters,
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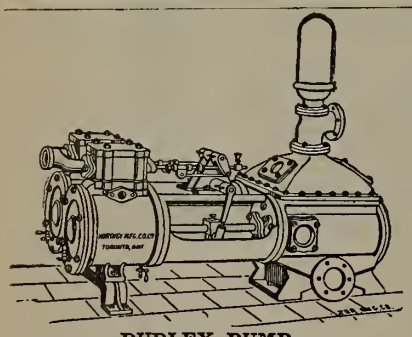

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Are up to date.

Single Steam Pumps.

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Sinking Pump.

CANADIAN MINING & MECHANICAL REVIEW

CONDUCTED BY - - - - - - B. T. A. BELL.

OFFICES:

Victoria Chambers, 140 Wellington Street,

OTTAWA.

Vol. XI. APRIL, 1892. No. 4.

The Mineral Revenue of Nova Scotia in 1891.

We are indebted to the courtesy of Mr. W. H. Brown, accountant of the Department of Works and Mines, Halifax, for the following returns, showing the revenue derived by the local government from its mines and minerals :—

Licenses o Search.

	1890.	1891.		
Cape Breton	$1,480	$1,470	$ 10	decrease.
Cumberland	1,340	570	770	"
Pictou	780	470	310	"
Inverness	750	420	330	"
Antigonish	350	120	230	"
Richmond	370	420	50	increase.
Hants, Lunenburg, Annapolis, Colchester, Digby, Victoria, Kings, Guysboro and Halifax	910	870	40	decrease.
	$5,980	$4,340		

Total decrease from Licenses to Search in 1891, as compared with 1890, $1,640.

Licenses to Work and Leases.

	1890.	1891.		
Cumberland	$ 900	$ 425	$475	decrease.
Cape Breton	800	450	350	"
Pictou	425	375	50	"
Inverness	325	125	200	"
Guysboro, Victoria, Antigonish, Colchester and Richmond	250	225	25	"
	$2,700	$1,600		

Total decrease of revenue from Licensces to Work and Leases in 1891 as compared with 1890, $1,100.

Rentals—Minerals other than Gold and Silver.

	1890.	1891.		
Pictou	$ 660	$ 570	$ 90	decrease.
Cumberland	390	840	450	increase.
Cape Breton	210	690	480	"
Colchester	30	60	30	"
Other counties	30	240	210	"
	$1,320	$2,400		

Total increase from rentals for minerals other than gold and silver in 1891 as compared with 1890, $1,080.

Coal Royalties.

	1890.	1891.		
Cape Breton	$ 63,833.29	$ 74,406.88	$10,573.59	in'cse.
Cumberland	37,595.39	43,042.17	5,446.78	"
Pictou	28,218.11	26,111.80	2,106.31	de'cse.
Other counties		11.25	11.25	inc'se.
	$129,646.76	$143,572.10		

Total increase from coal royalties in 1891 as compared with 1890, $13,925.31.

The following are the amounts received by the Department of Mines during year 1891, from various sources in connection with the gold product, from the under-named counties :

Prospecting Licenses.

Yarmouth	$ 127.50
Cumberland	179.00
Victoria	351.01
Kings	575.00
Queens	1,185.18
Guysboro	1,259.89
Hants	1,457.01
Lunenburg	1,534.62
Halifax	1,541.73
Colchester	1,633.05
Other counties	289.38
Total	$10,133.37

Rents—(Gold Leases).

Victoria	$ 48.00
Lunenburg	128.00
Colchester	142.00
Queens	142.00
Hants	196.00
Guysboro	380.00
Halifax	578.00
Other counties	8.00
Total	$1,622.00

Gold Rentals—(Yearly payments on Leases).

Yarmouth	33.00
Queens	189.00
Lunenburg	195.00
Colchester	202.50
Hants	206.50
Guysboro	236.50
Halifax	347.00
Total	$1,409.50

Royalty on Gold.

Colchester	$ 6.39
Lunenburg	9.87
Guysboro	527.42
Hants	1,239.72
Queens	2,195.69
Halifax	4,381.40
Total	$8,360.49

Head Him Off.

The Halifax *Critic*, whose reputation for blundering and misrepresentation in matters mining is notorious, eclipses all previous efforts by a profuse eulogy of—Great Scott !—Chas. M. Dobson. How Ontario mining men will smile when they read the following :

"The deep and intelligent interest in our mineral resources evinced by leading merchants and capitalists in St. John is in striking contrast with the apathy displayed by Halifax business men, who when they do invest generally lose, as they refuse to recognize native talent, but put up their money on the plausible tales of smooth-tongued outsiders who have absolutely no mining experience. There are of course numerous exceptions to this rule, but recent developments prove that it still holds good.

"Mr. Chas. M. Dobson, M. E. and C. E., of Chicago, has lately paid a visit to New Brunswick in the interests of Chicago capitalists, who contemplate the purchase of the Stockton manganese mines near Sussex. Mr. Dobson is a thorough metallurgist as well as mining engineer, and has had charge of some of the largest mines and reduction works in Arkansas and Colorado. He has held prominent positions in all parts of the world, and many large properties have been sold on his favourable reports. In his reports on the treatment of gold ores he always has a good word to say of the pattern of stamp mill manufactured in Nova Scotia, and on one occasion imported into the States a mill manufactured by the Truro Foundry and Machine Co. While in St. John Mr. Dobson received a large retainer from some gentlemen interested in gold mining at Isaac's Harbor and Country Harbor to visit and report on their property, and spent a short time in that part of the country. He was evidently most favorably impressed with both New Brunswick and Nova Scotia as favorable fields for the investment of capital in mining enterprise, and as he is now located in Chicago, where he has the best of connections, his visit here may result in important business."

It will perhaps be information to the *Critic* and to the "leading merchants and capitalists of St. John" to know that the subject of this flattering "puff" is a fraud, deadbeat and imposter of the very worst character. Dobson, who poses as an Associate of the Royal School of Mines and carries with him copies of credentials purporting to be from the eminent firm of London engineers, Messrs. John Taylor & Sons, all of which are fraudulent, is just one of these "smooth-tongued outsiders who have absolutely no mining experience," and against whose wiles the *Critic* so glibly warns its readers. His career in Ontario and Quebec during the years 1887, 1888 and 1889, when he posed as consulting engineer for the Vermilion Mining Co., special correspondent to the Toronto *Mail* from the Sudbury district, etc., etc., was notorious for the extent and audacity of his methods of swindling, and when he skipped to Chicago under a warrant for arrest on a criminal charge he left behind him many respectable citizens in Ottawa, Toronto and elsewhere to mourn his untimely departure. We have before us his *professional* card just as he presented it to us in 1887, and as it may be of some value to the *Critic* as a souvenir, we present it herewith :

CHAS. M. DOBSON, A.R.S.M., M.E.,

CONSULTING ENGINEER,

Mining & Reduction Works of all kinds Erected.

Reports on Mines and Mining Properties.

EXPERT OPINION.

OVER.

MR. DOBSON has had ten years PRACTICAL experience at the largest Galena mines in Great Britain, (Foxdale, Isle of Man), and on the South and West African Gold mines—Lisbon-Berlin, (Gold), Kimberley, (Diamond), and Gold Coast, (Gold) mines,—and on Canadian Phosphate and Mica Mines.

Special attention to the economical working of refractory auriferous ores.

MINING AND MINERAL LANDS BOUGHT AND SOLD.

LONDON, ENG., CORRESPONDENTS.

MINES WORKED AND DEVELOPED ON CONTRACT.

OFFICE: 23 Winton Chambers, Adelaide St., Toronto, Can.

The following is one of a series of letters utterly repudiating his claim to the A. R. S. M. :

ROYAL SCHOOL OF MINES,
South Kensington, S.W.
October 15th, 1891.

SIR,—On February 1st, 1889, you wrote to my father, Mr. J. S. Jeans, asking him if he could find out if Charles Miles Dobson was an associate of the Royal School of Mines. You said that Mr. Dobson had been concerned in some very questionable transactions. The council of the Royal School of Mines wish to get hold of a case of a man representing himself to be an A. R. S. M., in order that they may proceed against him. Could you oblige by writing and telling me if you know the whereabouts of Mr. Dobson, and if he still represents himself to be an associate of the R. S. M.

If you could give us any information that would lead us to finding him, you would greatly oblige

Yours, faithfully,
HAROLD JEANS.

We are sorely tempted to give a sketch at some length of the *modus operandi* of this blackguard, but as any such would necessarily involve the names of some respectable people whose feelings must be respected, we refrain. Suffice it to say that Charles Miles DeTracey Dobson is an unscrupulous and wholly unprincipled person, entirely devoid of any mining knowledge and ability, proved to be a liar and imposter almost without parallel; in fact, a dangerous character, whom our readers in the Maritime Provinces, in their own interests, will do well to have nothing whatever to do with.

With this number we present our readers with a very good portrait of our lamented friend the late Captain Tom Sheridan, manager of the Bell's Asbestos Company's mines at Thetford. Captain Sheridan was a miner of large and varied experience, and in the Eastern Townships, where he was so well known and so universally liked by his associates, his memory will be kept green for many a day.

EN PASSANT.

The interview of the Council of the General Mining Association of Quebec with the Hon. the Commissioner of Crown Lands, on 31st ulto., a full report of which will be found elsewhere, was the satisfactory outcome of the labors of the Association to have the mining law of the province placed on a satisfactory footing. The Hon. Mr. Flynn gave the impression of a minister who regarded the mineral development of the province as of the first importance and who would carefully consider any new legislation affecting its interests. He admitted that the confiscatory clauses of the Mercier Act had been repealed, and stated that in his opinion the industry had not arrived at that stage when it could be made a revenue-producing source to the government. He promised to submit the draft of any new Bill to the Council of the Association for suggestion.

The fee for powder licenses in Quebec is excessive and burdensome. Although not a provision of the Mining Act, it is a serious deterrent to the progress of the industry and the Council entertains hope that while it may perhaps not be abolished it will be very greatly reduced.

Through the courtesy of Mr. A. Blue, the recently appointed Director of Mines for the Province of Ontario, we are indebted for a glance at the advance sheets of his first annual report, from which the following summary of the mineral production for last year is taken: Nickel, 85,790 tons, of a value of $324,240, of which 4,536 tons, containing about 900 tons of nickel, were purchased by the United States Government for the manufacture of armour plate; silver, 14,925 tons, value $64,475; petroleum (crude), 894,647 barrels, value $1,209,558; mica, 240 tons, value $31,200; salt, 44,167 tons, value $157,000; gypsum, 5,350 tons, value $12.200; and phosphate, 4,900 tons, value $50,800. There were also produced building stone of a total value of $1,000,000; 48,221 bbls. of cement, valued at $44,501; lime, 2,350,000 bushels, of a value of $300,000; 160,000,000 common brick, value of $950,000; pressed brick, roofing tile and terra cotta, of a value of $156,699; drain tile, $90,000; sewer tile, $270,000; pottery, $45,000. The total value of the mineral production in Ontario for the year is thus computed to be of a value of $4,750,673 and the cost of labor employed therein, exclusive of the production of petroleum, salt and pottery, $1,659,141.

In order that our readers may be conversant with the subject of our article, "Head Him Off," we will publish in our next issue a cabinet portrait of the notorious Charles M. Dobson. Canadian and American papers need have no fear of libel suits in the reproduction of our article, as the REVIEW is in possession of ample evidence to bear out the charges in every particular—and a great deal more if necessary. Our only object is to put Canadian and American mining people thoroughly on their guard against this dangerous imposter.

At the Globe Works, Liverpool, there is in course of manufacture one of the largest steel wire cables that has been made in Great Britain. When completed it will be 3½ miles in one continuous length, without a joint or splice, and will weigh about 20 tons. It is 3¾ inches in circumference, made from the finest quality of patent crucible steel wire, and having a tensile guaranteed strain of over 40 tons. Some idea may be formed of the immense amount of labor required for the manipulation of an order of this kind, when it is mentioned that the total length of the wire in the cable would measure something over 300 miles. The machinery employed for this heavy work is of special design.

In a report upon questions relating to the employment of explosives in presence of fire-damp, prepared by a special sub-commission appointed by the French Government, the following conclusions are arrived at :—

1. Even explosives under water can inflame fire-damp mixtures with air by means of the dust of the mine.

2. The greater number of known explosives are capable of igniting fire-damp mixtures when exploded freely in the atmosphere. Amongst these explosives are dynamite, gun-cotton (either military or mining, particularly the latter), gelatine dynamite and Paulille's ammonia dynamite.

3. It is, however, possible to find explosives which detonate at a temperature sufficiently low to avoid inflammation with fire-damp mixtures, at least in the great majority of cases, when freely exploded in the atmosphere. Among the explosives experimented on which approximately fulfil this condition are: (1) The intimate mixture of 50 parts dynamite with 50 parts of crystallized carbonate of soda, or sulphate of soda, with 10 eqs. water of crystallization, ammonia alum and ammonium chloride; (2) Moulin-Blanc pyroselin powder; (3) mixture of 20 parts dynamite, at 75 per 100, and 80 parts of nitrate of ammonia; (4) mixture of 20 parts of guncotton titrating 173 c.c. nitrogen dioxide and 80 parts nitrate of ammonia; (5) Bellite, of which the composition is not known with certainty, and the experiments have not been sufficiently numerous; (6) Favier's explosive, containing 90 parts of nitrate of ammonia, 10 parts mononitro-napthaline, which appears to equal Bellite in security. It requires, however, further experiment.

4. Because of the complexity and variability of the phenomena occurring during the detonation of explosives free to air, it will be prudent to avoid firing shots in the mine, even with charges considered the safest, at points where the mixture of air and fire-damp is inflammable. The choice of explosives must be considered as diminishing danger, but not as absolutely suppressing it.

5. It is necessary to employ the explosives under conditions such as to develop from them the maximum useful work. Economy and security are in accordance to recommend this rule. To accomplish this the following conditions are necessary: The explosive must be rammed with care, and the hole must be sufficiently deep. No void space must be left either in front, behind or around the cartridge. The Bickford fuse must not be placed in contact with the explosive, if it is used, and the dangers of the fuse are sufficiently great to make it desirable to replace it by some more certain mode of ignition.

An enquiry, of great importance to colliery owners and miners, with regard to the use of explosives, was concluded at Atherton, near Wigan, in England, on March 1, in connection with the adjourned inquest upon the body of Edward Sandeland, collier. The deceased, after firing a roburite shot, in Messrs. Fletcher, Burrows & Co.'s colliery, complained of pains in his head, which he attributed to the explosive fumes. The pains brought on meningitis, which ended fatally on February 12, or three days after the inhalation of the noxious gas. The evidence of Dr. Martin was to the effect that the inhalation of noxious fumes, which brought about inflammation of the brain and membrane of the brane, was the primary cause of death. Dr. Paul, Professor of Medical Jurisprudence at the University College, Liverpool, said he had made an analytical examination, but with no positive result. He had discussed the matter with Dr. Martin, and thought the symptoms might be due to inflammation of the membranes of the brain, resulting from poisoning by substances like nitro-benzine or aniline, but there was no positive evidence to show that these ever did cause such inflammation, either directly or indirectly. So far as he could observe the man died from meningitis, and he thought the symptoms might be the result of poisoning by agents of the class named. In his opinion death from meningitis pure and simple in three days would be improbable. It might happen if there was some previous disease of the brain. Dr. Martin, recalled, said he was still of opinion that death resulted from the inhalation of noxious fumes. The jury, after ten minutes' consideration, found that death was due to the accidental inhalation of certain noxious gases liberated by the explosion of a roburite cartridge.

Conflicting reports reach us from Nova Scotia respecting the increased coal royalty. First we are told that the matter has been dropped for this session; then that the Premier says he will bring it on even if he is defeated; again we are informed that the lessees have played into the hands of the Government, have split among themselves, and are willing to compromise and pay an increasing rate of royalty for each successive term. Our readers, however, may rest assured that they did not form a mining society on the basis of the General Mining Association of the Province of Quebec to part company so soon. The lessees are unanimous. They have banded themselves together to see this question through. They rely on the justice of their case; at present they appeal to the moral justice of the Legislature, and if at first defeated they will not be discouraged, but fall back in good order to their lines before Public Opinion.

The organization of a strong and thoroughly representative union of the mining interests of Nova Scotia, noted elsewhere, marks an important epoch in the progress of mining in that province. The council and officers elected give confidence to the belief that, though the youngest, The Mining Society of Nova Scotia will soon take rank as the principal of our mining organizations. We heartily wish the association every success.

One of the first matters that will receive attention from the new organization will be the coal royalty. Informal discussions have been held with the Hon. Mr. Fielding, Provincial Secretary, touching what may be called a compromise between the claimants for moral justice on the one hand and the arbitrators of legislative power on the other. Secure to us, say the coal operators, fixity of tenure for the remainder of our leases and we will agree to pay, say, a royalty of ten cents "run of mine" for the whole period, although the consensus of legal opinion indicates that in a dispute between ordinary landlord and tenant, over the meaning of such an indenture as the coal lessees possess, the Supreme Court would decide in favour of the lessee. At these conferences, the Hon. Mr. Fielding has declared more than once that he did not propose to invoke the power of the Legislature but to exercise only the right held by the leases; yet at the same time he declined to allow the moral question of that right to be tested in the only satisfactory way it can be tested. He declined to allow a test case to go court. He declined to have it arbitrated on. He refuses to fix the rate of royalty except on an increasing scale on the full term.

Both sides are determined. The menace to the industry has become public, and as a result investmeuts in the province have received a check. An instance before us is that of certain Boston capitalists who have written their Nova Scotia friends saying "they will not purchase, but will surrender their bond if the Government persist in the proposal to raise the present rate of royalty." Holders of gold and other mineral property are greatly annoyed at the doubt thus thrown on the title to mining lands in Nova Scotia, and fear that the difficulty of getting capital to develop mines will be largely increased unless the Legislature are roused to the seriousness of the question and at once pass a measure giving ample and unqualified security of title. Anent this deplorable measure, too much prominence cannot be given to Dr. Raymond's outspoken criticism of the policy, unfortunately too frequent these days, of squeezing Government revenue out of invested capital and industries. Dr. Raymond is, as all the world knows, secretary of the American Institute of Mining Engineers, and as a writer has given special study to the subject of mining legislation. In a recent contribution to the *Engineering and Mining Journal* he says:

"1. It will be useless to expect further investments of capital from abroad for the development of Nova Scotian resources if investors are given to understand that the conditions of their tenancy are liable to sudden change. The mere reservation, in some leases, of the power of the Province to make such change has been, to my personal knowledge, a hindrance to investments hitherto. Cautious capitalists have declined to put money into plant and mining work subject to the will of the Legislature as to their rights and obligations. Many have made investments, nevertheless, on the earnest assurance of promoters that, although the Legislature could alter the terms of leases, it would not do so, because it was heartily desirous to favour the development of the natural resources of the province. If this confidence is now proved fallacious, there will be no basis on which investment can safely be made here.

"2. It is highly demoralizing for any Government to make agreements with private citizens or corporations, in the terms of which an unlimited power of change is reserved to the Legislature. In the United States, coal and other mineral lands are sold outright, and the owners are taxed like other property-holders. This is one reason of the comparative ease with which capital can be secured here for such investments. It would be, in my judgment, better for Nova Scotia to adopt a similar policy. But if the coal lands are to be leased, then the Government should do as private owners do, namely, lease for a fixed period (25 or 30 years) at a specified royalty, and bind itself not to change that royalty until the end of that period. The effect of leaving the Legislature free to change it 'from time to time' is simply to make lessees dependent, not upon clearly defined rights of which they cannot be deprived, but upon the favorable or unfavorable action of a varying body of men, who have to be influenced, legitimately or illegitimately, to let the leases alone. This means, in the best case, considerable expense to the lessees for the proper representation of their case to successive legislatures. In the worst case, it means lobbying, bribery, and legislative black-mail. Canadian politics have furnished some recent instances, going to show that the worst may be apprehended in that latitude, as well as in this. I have no reason whatever to suspect the motives of the present Legislature of Nova Scotia. If I believed that body to be actuated by unworthy motives, I would waste no words in argument. On the contrary, I would simply say to my friends engaged in coal mining in Nova Scotia, 'These men want to be bribed to take their hands off your business. It is your duty to suffer the injury they threaten, rather than yield to their demands.' Perhaps my advice would not be followed; perhaps the crisis would be averted by secret means to the great injury of political morals, and a certain loss, besides, to the capitalists themselves, for nothing is more ruinous than to pay black-mail once, leaving to the next and the next and the next set of marauders not only the power to levy it again, but the encouragement of the established precedent.

"I would add here, that not merely the corruption of individual legislators, but also the changes of party control, are to be feared in such matters. A party in power, for instance, enthusiastically favours 'improvements' of all kinds; it offers bonuses, loans, cheap railroad rates, low taxes or no taxes, low royalties and large franchises, to attract and stimulate enterprise. It gets up a 'boom," in short, and when the boom begins to decline, the business reaction from over-speculation extends to politics also, and the other party comes into power. Perhaps this alternation is a public benefit on the whole. No doubt the new administration is bound to overhaul the work of its predecessor, to correct abuses, to undo the result of actual fraud, and to adopt for the future whatever system it may deem better for the public welfare, But if it is to be understood that such 'reforms' are to include the revision of the terms of bona fide leases of land (even the right of such revision has been expressly reserved to the Government), the result will be to force the representatives of the capital invested in such leases, and in extensive operations connected therewith, to act, in pure self-defence, with one political party, to supply money for its expenses, and to influence employés in its favour. The corrupting influence of this situation cannot be over-rated.

"The net result of both the factors above described will certainly be, that the investment of capital for enterprises dependent for their profits upon the arbitrary action of the Legislature will be confined to parties who believe they have and can keep a 'pull' on the Legislature, either through alliance with the party in power, or through control of individual legislators. But such a 'pull' costs money, a great deal of money. Nobody who is willing to employ such means is fool enough to do so unless the profits of the business will be so large as to warrant this extra risk and expense. Such large profits cannot be made under free competition. Hence the industry itself is likely to be restricted, and the prices of the product are kept higher than they would be if capital were not thus handicapped, The total result, therefore, includes not only the demoralization of politics, but the retardation of industrial development.

"3. I doubt whether an increase of royalty upon coal could be borne by the collieries of Nova Scotia generally. Certainly the weaker enterprises would be seriously injured by it, and thus the business would be delivered into fewer hands, which is just what the public interest does not require. All taxes on gross product, without regard to cost of productlon, have this bad tenancy period. It is only when they are very small indeed that it may be overlooked. But whether the collieries can stand it or not, its future effect upon the Province would be disastrous, by introducing into the problems of industrial enterprise an element of unnecessary insecurity. There is insecurity enough, earth knows, in mining enterprise, without inventing new means of discouraging its promoters.

"There has never been, prohably, more unemployed capital in London, Berlin, Paris and New York, than there is to-day. Yet it has seldom been so difficult to enlist it in promising enterprises. One principal reason is declared to be (and I believe the statement), the hostility shown by legislatures to capitalists and corporations. Granger laws, special tax-laws, laws dictating prices of commodities, and a host of other fanciful experiments in 'State Socialism,' are driving away capital from the places that need it most. Would it be wise for Nova Scotia to join this procession of folly, and give notice that she also 'from time to time,' intends to pluck and squeeze, and see how near she can come to killing, the goose that lays *her* golden eggs? If she does, even geese will shun her shores hereafter.

"4. 'But,' it may be asked, 'if it should be clear that the royalty now paid upon coal is smaller than, in fairness to the Province and without injustice to the industry, it ought to be, may not the Legislature, now or at any other time, at least wherever it has the expressly reserved right to change the royalty, exercise that right.

"My answer is that, as to future leases, there can be no question, and it would be a very good thing for the Legislature to try the experiment and see whether, under the higher royalty imposed, anybody would want to lease the lands. As to lands leased but not worked, there might be no special harm done by giving notice of a higher royalty to be exacted when work should be begun. But in both these cases I think assurance should be given that this new royalty would not be raised again for a period of years long enough to justify the investment of capital in extensive operations. Finally, as to enterprises now active upon leased lands, I think an immediate increase of royalty, whether lawful or not, would be in the highest degree unwise, and would inflict upon the Province an injury far greater than any benefit which could be expected from a temporary increase of revenue."

The Government of Nova Scotia has introduced their bill raising the royalty on coal 33⅓ per cent. Then, by separate Act, they propose to fix the date at which the increased royalty shall take effect. They name the 23rd of February, 1892! This is hardly credible. Casting to the winds all pretence of acting within their rights as lessors, they propose retroactive legislation. To demand additional royalty on quarterly returns for the period ending March 31st, already fyled, is indeed exercising the power of the Legislature with a vengeance.

How different to the honourable consideration for vested rights in Ontario by the Legislature of that province, which so lately carefully abstained from including in the rates of royalty leases granted prior to the passage of the Act imposing the new rates.

How different to the cautious regard for the rights of the lessees shown by this same House of Assembly in Nova Scotia in 1866, when, in furtherance of the interests of that province and the lessees whose capital had done so much to develop its resources, there was passed an Act which allowed renewals and gave, as was then supposed, a fixity of tenure, an Act which induced further expenditures of capital in that province.

The mineral lessees of Nova Scotia show legal opinion in writing, from prominent lawyers on both sides of politics, contending that the Legislature has not, as a matter of contract, the right to have, at the present time, a legislative revision of the royalty. The Government say they do not propose to exercise their power to over-ride contracts, and the Attorney-General declared he would blush were a breach of faith ever thought of in connection with this royalty measure. This is tantamount to saying the intention of the indentures should decide this difference of opinion. Why then is the offer of the lessees to have a test case go into court, not accepted?

An English company are making at Hartlepool, a new rope, which is called the anti-corrosive and self-lubricating strand wire rope. In

the process of its manufacture, the cores and all the wires in the strands are, we are informed, thoroughly coated with a preservative composition called glissantoline, which fills up the interstices of the rope, and makes it perfectly impervious against corrosion, as by bad water, steam, or other deleterious matter found in the workings of mines or elsewhere. It at the same time acts as a lubricant to the individual wires, and insures greater flexibility.

According to the trade and navigation returns, Canada imported for home consumption 1,598,855 tons of bituminous and 1,399,067 tons of anthracite coal during the fiscal year ending June 30, 1891. During that time there was exported 833,684 tons of bituminous coal, the product of Canadian mines. Of the total quantity of bituminous coal imported, 36,002 tons arrived from Great Britain and 1,562,753 tons from the United States. The total duty collected, at 60 cents per ton was $959,368. Of the total quantity imported 1,510,411 tons were taken by Ontario; 72,880 tons by Quebec; 28 tons by Nova Scotia; 4,491 tons by New Brunswick; 9,788 tons by Manitoba; 1,098 tons by British Columbia, and 159 tons by Northwest Territories. Turning now to anthracite coal which is imported duty free, the total quantity imported was 1,309,067 tons distributed as follows: Ontario, 931,463 tons; Quebec, 375,615 tons; Nova Scotia, 33,146 tons; New Brunswick, 50,375 tons; Manitoba, 6,224 tons; P. E. Island, 2,244 tons. Total value of anthracite coal imported into Canada during the year from the United States, $5,244,452. Turning now to exports, Canada shipped, as already shown, 833,684 tons of bituminous coal during the year ending June 30, 1891. Of this Nova Scotia mines exported 173,105 tons, Quebec 10,262 tons, and British Columbia 647,508 tons. The Northwest Territories sent out 223 tons. Of the products of the Canadian bituminous mines, Great Britain took 25,940 tons; Newfoundland, 73,397 tons; Sandwich Islands, 12,266 tons, and the United States 692,705 tons, the greater part of which was sent from British Columbia mines to Pacific ports in the United States.

The attention of Parliament was called the other day to the question of Civil Servants contravening the Civil Service Act by holding an interest in mineral lands and mines. This reminds us of a flagrant breach of the Act very apparent in the conduct of at least one member of the staff of the Geological Survey of Canada, and an Assistant Director at that, who makes a specialty of doing professional work, mainly on Sundays, for a consideration. This party has, to our knowledge, been employed reporting on mineral properties for certain corporations and individuals, and takes a fee—which from his salary he can very well afford to do—at less than half of the ordinary expert's tariff for such work. This is an injustice to the men who live solely by doing work of this kind, and we wish to see it put a stop to. In order that there may be no misconception as to who we refer to, we distinctly charge Dr. Robert Bell with being the offender referred to. We have in our mind at the present time his reports, written on the basis of a commercial negotiation, as follows: for Mr. George Stewart, on the High Falls phosphate properties, in 1889; for Mr. C. M. Pielsticker, London, Eng., on the McMillan property, in 1889; for the late Mr. Adamson, on the Victoria mine; on the Little Rapids property, for Mr. W. A. Allan. There are many other cases, but these are sufficient for our purpose.

The coal trade of Montreal is one that gives employment to a very large number of vessels during the season of navigation, and the prospects for the present year are therefore a matter of some interest. From present appearances there is not likely to be much increase in the volume of business, but it is even now evident that the trade is going to hold its own. Last year some 550,000 tons of Lower Port coal were brought to Montreal by water. This year purchasing has commenced about as usual, and most of the large orders have already been placed. The Gas Company, however, is not going to use as much coal this year. Last year the Gas Company purchased 55,000 tons of coal. It takes 25,000 tons less this year, but as the company has a stock of 10,000 tons left over, its total consumption this year will be in the neighborhood of 15,000 tons less than last year. The railroads have made their arrangements for their purchases. The Grand Trunk takes about 95,000 tons of Lower Port coal, and some 40,000 tons of American coal. The Canadian Pacific Railway takes about 125,000 tons of Nova Scotia coal. The big manufacturers are now placing their orders. This is the usual time for them, for if they do not purchase now the mines cannot make arrangement for tonnage to supply the orders. There are some 25,000 ton orders yet to come in, however. The sugar refineries, which usually take that amount each, are expected to place their orders at once. Steamship freights opened higher than last year, but as more tonnage came upon the market there was a decline, and the later boats were chartered at about last year's figures. There are still a couple of more boats to be fixed, however.

London advices of March 9th say: "As to the phosphate market, its position may almost be called an absurd one. People are trying hard to sell Florida phosphate, 75 per cent., at 8½d. A few cargoes have come over 80 per cent., but have not been sold at the price of 80 per cent., but at the price of 75 or 78 per cent., with rise, as the mine owners can never depend on 80 per cent. Florida 70 per cent. is unsaleable, but Bull River 60 per cent. can be placed at about 8½d, the reason for its preference being that manufacturers are in the habit of using it with low Belgian stuff, and it does not pay them to make any alteration in their plant, at least until Florida shall have thoroughly established itself in the market. The manufacturers' position appears to be one of great soreness. They have over-stocked themselves at what they thought bottom prices, and the bottom has fallen out, and now they find remunerative sales difficult. By May or June we may have a different state of things, but just at present two or three of our leading brokers are selling against one another for the purpose of realisation and finance. The market is simply in an impossible state."

The appearance of Mr. Sando in Canada, together with the resignation of Mr. Wills, the manager, and the abrupt termination of the Stewart contract, would seem to indicate an entire reconstruction on the part of the General Phosphate Corporation, Ltd. The company is unquestionably in a very bad way, and its dissolution seems not very far distant. From the very start its affairs have been grossly mismanaged. Money has been thrown away wholesale on the purchase of properties whose values were entirely unproved and whose subsequent working has equally failed to justify a fraction of the expenditure upon them. The balance sheet printed in a recent issue of this paper records an outlay for the purchase of some 2,660 acres of virgin lands, together with £7,798 10s. 6d., paid on option for the North Star mine, at no less than £106,662 1s. 7d., while the expenses in London and at the mines have amounted to nearly £42,000. The quantity of phosphate produced in eighteen months' working only amounted to 1,000 tons, realising £3,339. When we compare this miserable result with the glowing statements set forth in the prospectus, estimating "an annual output of from 80,000 to 100,000 tons, realising an average net profit of from £1 to £1 10s. per ton," we are disposed to smile. It is obvious that these statements were made either without knowledge, or with the deliberate intent to mislead the public. It is indisputable that the directors went to allotment upon an absurdly insufficient capital; the promises of the prospectus have not been performed; the properties which were acquired by raising debentures, and thus mortgaging the credit of the company, have resulted in a loss, while the promoters and vendors are the only persons who have obtained any benefit from the promotion. The whole concern is but one more monument to English capital ill-applied and grossly mismanaged.

The Financial *Critic*, in an outspoken article handles the company without gloves. This is what it says: "Had the over-sanguine expectations of the promoters been realised in regard to the half of the £1,000,000 which was offered for subscription, doubtless some of these properties *would* have been acquired. But fortunately for themselves the public for once in a way were not slow to perceive some of the many weak points which abounded in the prospectus, and consequently stood pretty generally aloof. Notwithstanding that every will-o'-the-wisp dodge known to promoters was practised to abstract subscriptions, and hundreds of

pounds expended in advertisements, *only about 4,000 shares were subscribed by bona fide investors*, so that the founders, the majority of whom expected to be relieved of their guarantee of the subscription of fifty ordinary shares for every founder's share they accepted, were compelled to keep the full amount of ordinary shares guaranteed to be taken up. This represents about 15,000 shares, or a total in all of about £19,000, upon which ostensibly £2 has been called up, yielding, or rather that should have yielded, a capital to the company of £38,000. We think, however, it would puzzle the directors to prove that these calls have been paid, inasmuch as such a proceeding would affect very seriously some of these so-called founders, who never had the least contemplation of being saddled with any liability. The list of founders that was issued with the prospectus included a galaxy of high-standing and distinguished members of the Peerage, and of gentlemen whose names are known throughout the United Kingdom. The directorate, too, was a strong and faultless array, and the only wonder is that investors at large were not more dazzled and carried away by their imagination than they appear to have been. There is little doubt, however, that many of those who subscribed for shares did so in the belief that the prominent gentlemen whose names appear on the list had subscribed for ordinary and founders' shares, but we have reason to know that the said list was nothing more than what we may expressively name a 'bogy,' and fit only to rank with such beautiful specimens of the Dandoic, irresponsible compilation art as were exposed in the cases of the Metropolitan Coal Consumers' Association, and the Whole Meal Bread Company. If proof of this were needed, it is to be found in comparison of this list with the register of members of the company, which reveals the fact that a large proportion of the names appearing upon it as founders, do not, and actually never have held a single share, founder's or otherwise. With regard to the directors, Sir James Whitehead and Mr. Sampson S. Lloyd, who practically composed the business element of the board, were not slow to grasp the true state of affairs, and without prevarication resigned their seats forthwith. As to the wisdom of the step, there can be no question, and if the truth were known, Lord Stalbridge himself must regret the hesitation he displayed in following their lead"

One of the features of the ensuing meeting of the General Mining Association of Quebec will be a paper on "The Present Status of the Canadian Asbestos Industry," by our genial friend, Mr. L. A. Klein, of the American Asbestos Company.

The union of Mr. E. D. Ingall, of the Division of Mineral Statistics and Mines, with Miss Rand, of New York, is reported. The REVIEW hastens to express its congratulations and good wishes for the happy couple. The event is another outcome of the Ottawa meeting of the American Institute of Mining Engineers in 1889.

The "Bulletin" of the British Iron Trade Association, just issued, gives the total production of pig in the United Kingdom in 1891 as 7,228,496 tons, or a decrease of 646,634 tons as compared with 1890. There was a production of 1,642,005 tons of Bessemer steel ingots, or a reduction of 372,838 tons, the production of acid and basic steel ingots being 1,306,229 acid, 355,756 basic.

The district mine inspectors appointed by the late Mercier Administration have been dismissed. This is an economy which will save the Government several thousand dollars and which will rid the industry of a class of men who were of no earthly use to it.

Reports from Florida contain the statement that the phosphate boom in that country is at an end, and with the reaction a number of failures are announced. Many of the works are shut down and others are soon to follow. An English authority states that a very large proportion of the quantity exported as high test phosphate has proved of inferior quality.

The next quarterly general meeting of the Mining Society of Nova Scotia will be held at Halifax on or about the 15th June next. This date, following as it will close upon the meeting of the General Mining Association of Quebec, at Black Lake, will give an opportunity to the Upper Province men to visit and interchange ideas with their Nova Scotia brethren, which we trust will be liberally taken advantage of.

There has lately been issued an important bulletin on the forest and mineral wealth of Brazil by the Bureau of the American Republics, which states that scientific explorers have found great deposits of coal and iron, and have also proved that the country possesses copper, manganese, and argentiferous lead ore. There are also mines of gold and diamonds. Diamonds are co-extensive with the gold deposits, and like that metal, are most abundant in Minas Gereas, where they have been found since 1879. The most important locality known for the production of these gems is the district of Diamantina, in the above-named State. They are found in Parana, in the gravels of the river Tibagy, and in the beds of streams dry during the summer. Since the discovery of diamonds at the Cape of Good Hope, the Brazilian production has greatly diminished. As regards iron, the State of Minas Garaes abounds with it. It is not found in veins or strata, buried deep in the earth, but in enormous beds, often lying at the surface, or in mountain masses. These vast deposits are worked only by small scattered furnaces, charcoal being used in the reduction of the ore. Of these small furnaces there are five groups, producing about 3,000 tons annually, the product being used in the surrounding districts in the manufacture of articles of home consumption, such as hoes, shovels, picks, drills, nails, horse shoes, &c. In the State of San Paulo are found deposits similar to the best Norwegian ore, and one of the mines is worked by the Government establishment near the village of Soracaba. This establishment has two furnaces, and produced in one year about 790 tons of pig iron. The ore has about 67 per cent. of iron. In Santa Catarina, not far from a harbour accessible to the largest vessels, are vast deposits of hematite, containing, on an average, 30 per cent. of manganese and 20 to 30 per cent. of iron. In the State of Goyaz, as in Minas Geraes, are found enormous masses of the ore taberite.

Summaries of the statistical portion of the reports of her Majesty's Inspectors of Mines for the year 1891 have just been issued as a Blue Book. These summaries show that during the year 1891 the total number of persons employed in and about all the mines in the United Kingdom of Great Britain and Ireland, together with the Isle of Man, and inclusive of those employed on private branch railways and tramways, and in washing and coking coal on premises adjacent to or belonging to the mines, amounted to 707,411, of whom 6,112 were females above ground. The number of persons employed in and about all the mines, exclusive of those employed on private branch railways and tramways, and in washing and coking coal, was 687,878, of whom 5,819 were females, the aggregate increase being 32,581. The total number of fatal accidents was 961, and the total number of deaths occasioned thereby 1,030, being an increase of 62 in the number of fatal accidents, and a decrease of 176 in the number of lives lost, compared with the totals of the preceding year. There was one death for every 668 persons employed, which is more favorable than the ratio one in 543, of the preceding year. In the mines classed under the Coal Mines Regulation Act, the total quantity of mineral wrought in the different districts was 197,693,592 tons, of which 185,479,146 was coal, and 29,150 ironstone, the rest being fireclay, oil shale, and other minerals, making a total increase of 3,087,705 tons, compared with the preceding year, there beng an increase of 3,864,838 tons of coal, but a decrease of 888.326 tons of ironstone. One of the summaries shows the ratios of the fatal accidents and the deaths to the number of persons in and about mines under the present and former Coal Mines Acts, given in averages for the periods covered by the first three Acts, and in detail with the averages since 1878, from which it appears that the occupation of the miner is now very much safer than at the commencement of the Mining Acts, the average ratio under the first Act being one death in every 233 persons employed, under the second Act one death in 258, under the third Act one death in 312, under the fourth Act one death in 466, whilst for the present year it is one in 662, a much more favourable ratio. The ratios of accidents and deaths to the number of persons employed, and tons of mineral wrought in each of the districts shows a general average of 217,007 tons of mineral wrought for every fatal accident, and 201,934 tons for every death, as compared with the more favourable quantity

of 226,023 tons per fatal accident and the less favourable quantity of 167,763 tons per death in the preceding year. The number of persons employed on private branch railways and tramways, and in washing and coking coal on premises adjacent to or belonging to the mines, was 19,533, of whom 293 were females. The number of fatal accidents was 26, the number of deaths resulting therefrom was 26, and there was one fatal accident for every 751, and one death for every 751 persons employed, which are more favourable ratios than in the preceding year. During the year 1891 the total number of persons employed in and about the mines under the Metalliferous Mines Regulation Act was 38,418, of whom 1,363 were females employed above ground. There were 50 fatal accidents and 51 deaths, the number of accidents being 12 more and the number of deaths 5 more than in the preceding year. There was one fatal accident for every 788 persons employed, and one death for every 773 persons employed, which are less favourable ratios than in the preceding year.

CORRESPONDENCE.

The Quebec Mining Inspectors.

SIR,—The Government of Quebec being about to appoint a Mining Inspector for that Province, it is highly important to the future welfare of our Mining Industries that a suitable man should be chosen and entrusted with this position.

We have heard a great deal lately from electioneering platforms about the pernicious effect of the incompetence of men holding this authority, obtained by no other recommendation than political bias and favour, and we surmise that the DeBoucherville Cabinet will steadfastly avoid such influence in making their choice.

This Government has already expressed its determination to very carefully revise the Mining Act, through the IIon. Commissioner of Crown Lands, as communicated to the Council of the General Mining Association of Quebec on the 31st of March last, and everyone interested in the successful development of the natural resources of the Province, look to this new measure with eagerness and confidence.

Its practical effect, however, will depend to a very large extent on the abilities of the officers who have to put it into execution, and all practical mining men will agree that the Inspector to be appointed cannot be too efficient in the profession which he is called upon to exercise.

It is publicly known that several of the candidates for the position are neither graduates of any school, nor have they received any technical education whatever which is required to fit them for their duties, and such men could never render any benefit or honour to the position which they would thus usurp.

It cannot be ignored that a Mining Inspector should possess at least an elementary acquaintance with (in addition to the three R's) physics, inorganic chemistry and analysis, surveying, mineralogy, metallurgy, geology, mechanics, steam, etc., and *practical mining*. Would it not, therefore, be desirable to make a competitive examination the basis of the selection of this Inspector?

Another point which should be rigorously enforced is the inadmissibility of any candidate for this inspectorship who may hold or possess any personal or pecuniary interest whatever in any mining or metallurgical enterprise carried on within the territory of his jurisdiction, or who may be a speculator in undeveloped properties or mineral lands. (Vide Quebec Statutes, sections 46, 114 Victoria, chap. XII.)

We hope to see that our legislators and those interested in the development of our mineral resources will take this matter up in the most serious manner and correct the mistakes of past experience, and thus assist an industry and natural wealth which only needs their wisdom and attention in order to revive it.

JOS. LAINSON WILLS, M.E.

OTTAWA, April 26th, 1892.

The Cost of a Small Blast Furnace Plant.

SIR,—Would you be so kind as to furnish me, through your columns, with some idea of the cost of the equipment of a 50, 80 and 100 ton furnace?

Yours, etc.,

T. B.

KINGSTON, 29th April, 1892.

[We will attempt to reply to this question, which is far from being an easy one, for the cost of a blast furnace depends, first, on its location, second, upon its equipment, and, third, upon the general character and finish of the work.

The capacity or output of a blast furnace is also dependent upon the ores used, the fuel available, the character of the equipment, and, more than anything else, upon the management. Therefore, what would be a 50 ton furnace in one location might with different ores and fuel, and even different management, be an 80 and even a 100 ton furnace.

Basing cost upon a good substantial construction, where building material does not command excessive prices, where machinery can be purchased cheaply and where labour is not above normal conditions, a blast furnace substantially constructed, free from unnecessary ornamentation and equipped with good machinery, which could under efficient management, using easily smelting ores high in iron and satisfactory coke, produce the quantities named, would cost about as follows: A 50 ton furnace, $80,000 to $100,000; an 80 ton furnace, $100,000 to $125,000; and a 100 ton furnace $125,000 to $150,000. There would be little difference between the cost of a 50 and 60 ton furnace.

The above estimates are intended to cover a complete plant, ready for operation, which can produce continuously the quantity of iron named, and are not plants of smaller capacity which can periodically be spurred up to the outputs you require. Of course, furnaces can be constructed much cheaper than the figures given, or can be embellished to add largely to the cost. These figures are only approximations, for unless we knew the location, the character of the material to be used, the kind of product to be made, we would be unwilling to be quoted as giving the estimate.—EDITOR.]

Impressions of Kootenay.

SIR,—In response to your request to give you my impressions of the Kootenay District of British Columbia, I have pleasure in sending you a brief report. At the time of my visit the snow was on the mountains and was not expected to disappear from the most noted mineral locations until the middle of May. I can, therefore, do little more than give you a general description of the country and a report of the talk of the region, and this can be done in one word for each topic—mountains and boom. The hills make a sheer ascent from the magnificent waterways, and from the centre of Kootenay Lake more than fifty peaks are visible, with the assurance of a limitless sea of mountains beyond. The best mineral prospects yet found are at an elevation of from 4,000 to 6,000 feet, and at present there are no electric railways or cable cars to afford easy access. The hills, however, are not as heavily timbered as in some other regions, and I have seen fully as difficult places to prospect in the County of Ottawa. There being no hardwood, the undergrowth is not so thick as with us, though the fallen trees are a serious obstacle. I was surprised to find that there are as yet no productive mines in that district; the great number of the so-called mines being unexplored locations—sometimes made in the snow. There are, however, a few properties on which enough development work has been done to determine their value. The most notable, and in fact the only "bonanza," is the "Silver King," on Toad Mountain, near Nelson, which by a tunnel of 850 feet, is said to have proved ore "in sight" to the value of $1,600,000, and which is estimated to have at least $100,000 in the dump. This is a "dry ore" containing copper, and is said to give from 30 to 1,000 oz. of silver to the ton. No one is allowed to visit the mine and the reports of values are so conflicting that it is difficult to form an opinion. One person, who had good sources of information, told me that the ore would average 50 ounces of silver to the ton, and that the vein in the end of the tunnel just now was only 14 inches in width. Other reports make the vein the whole size of the tunnel with more beyond. As the mine is merely being exploited for the English stock market, no dependence can be placed on the rumours.

At Ainsworth half a dozen properties have been tested by shafts to the extent, in one case, of 120 feet. The ores are chiefly of argentiferous galena, and the seams vary from a few inches to several feet. Some streaks of ore containing ruby, silver and wire silver are found, giving very high assays, but I judge that an average of 30 to 50 ounces to the ton is a representative value for this region. I asked the foreman at one mine what his ore would assay and his reply was, "Anything you like to make it;" an answer which explains the wide variation in assays. I visited one prospect showing two feet of galena ore, which at the end of a tunnel of 30 feet had narrowed to two inches, and so it goes in and out as minerals have a way of doing in other localities.

Near the Slocan Lake, some 20 miles north-west of Ainsworth, rich samples of ore were picked up last fall asssaying from 100 to 2,000 ounces of silver to the ton. The principal finds were at an elevation of 6,000 feet, and as yet no development work has been done that can afford any idea of the extent of the deposits. A large number of men are going in with tents, camping at the edge of the snow, and prospecting up the mountains as the thaw progresses. Some claims have been sold to parties who will provide funds for development, and this season's work will show what the ground is made of.

The mining laws are very liberal, and Capt. Napoleon Fitz Stubbs, the Gold Commissioner, exercises an equitable control over the region. A smelter is being built at Pilot Bay, 8 miles from Ainsworth, on the east side of the lake, under the direction of Dr. Hendryx, and there are numerous proposed railways. The construction of a finishing connection with the existing road from Little Dalles to Spokane, Washington, has been opposed by the Canadian Pacific Railway, which naturally wishes to control transportation; but as nearly all the work is being done by United States capital, the establishment of a railroad to the south is a foregone conclusion.

The chief difficulty with regard to the development of the region is the political commercial restriction. The bulk of the supplies must come from the United States, and their cost is greatly enhanced by the Canadian tariff, while on the other hand the export of products is met by the United States duty of $30 a ton on lead. The country is thus between two fires, and must suffer from these embarrassments. It may be, however, that the ores may prove rich enough to bear the burden of these imposts and of the efforts made to make commerce conform to national lines rather than to geographical laws; but every one feels that the country is politically in an unfortunate position.

The town of Nelson is thriving, and a corner lot, 50 x 120 feet, has been sold for $4,000. Lots in the "new and thriving City of Kaslo" are selling at $400 each, although at the time of my visit the city consisted of two houses and a prospective store. A new town, Eldorado City, near Slocan Lake, is starting this spring, and some twenty edifices have already been put up. There will be a great rush of people to the region this summer, and doubtless some very rich finds will be made, and some still richer ones will be reported. Although there will necessarily be much disappointment, the air of the region is charged with hopefulness, and as a miner remarked to me, "A downhearted man in this country is a curiosity." I can perhaps give you the best summary of my impressions by saying that while realising the risks and difficulties so keenly that my enthusiasm is not of a booming nature, I am going to send out my own prospectors to try their skill and more especially their luck in the Slocan region.

ROBERT C. ADAMS.

MONTREAL, April 25th, 1892.

The Quebec Mining Act—Satisfactory Interview with the Hon. E. J. Flynn, Commissioner of Crown Lands—A Liberal Measure Promised.

On Thursday, 31st ulto., the following deputation, representing the General Mining Association, of the Province of Quebec, had the honor of an interview with the Commissioner of Crown Lands at Quebec, with reference to the mining law of the Province:—Hon. George Irvine, Q. C., (Johnson's Company,) Quebec, *President;* James King, M.P.P., (King Bros.,) Quebec, *Vice-President;* L. A. Klein, (American Asbestos Co.,) Black Lake Que.; John J. Penhale (United Asbestos Co.,) Black Lake, Que.; Capt. Mathew Penhale, (Glasgow and Montreal Asbestos Co.,) Black Lake, Que.; Col. Lucke, (Beaver Asbestos Co.,) Sherbrooke; A. M. Evans, M. E., (King Bros.,) Black Lake, Que.; O. M. Harris (Canadian Phosphate Co.,) Montreal; J. Lainson-Wills, F. C. S., (General Phosphate Corporation) Ottawa; J. B. Peters, (Peters' Asbestos Mine,) Quebec; J. Burley Smith, M. E., (Anglo-Continental Guano Works Co.,) Glenalmond, Que.; R. T. Hopper, (Anglo-Canadian Asbestos Co.,) Montreal; W. H. Jeffrey, (Jeffrey Asbestos Mine) Richmond, Que., B. T. A. Bell, Editor CANADIAN MINING REVIEW, Ottawa, *Secretary*. The deputation was received by the Hon. Mr. Flynn and the Hon. Mr. Pelletier, Attorney-General.

HON. GEORGE IRVINE, Q.C., having explained the object of the interview, stated that he believed the Government had repealed the confiscatory clauses of the Mercier Act. Is that so?

HON. E. J. FLYNN—Yes, I believe so.

HON. MR. IRVINE, resuming, dwelt upon the extent and importance of the mineral resources and the benefits to be derived by the province from its fullest growth and prosperity. That portion of the country on the line of

the Quebec Central Railway where his mines were situated was, until the establishment of the asbestos industry, a barren and uninhabitable wilderness, but with the opening of the asbestos mines there had grown up large settlements and a prosperous community. Mining was certainly an industry worthy of being encouraged by the most liberal legislation. Two years ago the Dominion Government, with a view to its extension throughout the country, had admitted free of duty all machinery of a kind or class not already manufactured in the country. This has proved a great benefit to the producer, inasmuch as it permitted him to import certain classes of machinery, indispensable to his work, not to be had in Canada. The Mercier Act was probably not intended to be unjust, as some of its provisions assuredly were. It was framed and passed without obtaining the views of the persons engaged in mining, who were the only competent parties to be consulted, or who could give information on a matter of so vital importance to them. The bill was passed through the House, he thought, in one day's sitting —certainly in two—and the following day was printed. The miners were given no time to object or suggest amendments. The royalty on the gross product, which he was glad to hear had been repealed—at all events on mining lands sold by the Crown prior to 1880—was most unjust. Many of the companies made very large expenditures in labor and machinery, and the returns often were small, in some cases none at all. This royalty, if carried out, would have diminished or annulled these small profits, while the loss of the companies not making any profits would be greater. The mining community, he thought, contributed already, by their corporation taxes, imposts on powder magazines, municipally and otherwise, more than their fair share of the public revenue. They certainly did not object to contribute their fair share of taxation, but it must be just and equitable. Royalty on the output of mines was a pernicious system that was generally condemned by miners all the world over. He was sure the Government would gain more—at all events the producer would—by the total abolition of any royalties on the product of the mines. It would be better to sell the mineral properties of the Crown at a good price outright. The old practice of placing them up at public auction had worked acceptably. He pointed out that the Mercier Act gave extraordinary powers to inspectors; such as determining boundaries—which he claimed should be settled by the courts by action *en bornage*. One good inspector was quite sufficient. The men appointed were people who knew nothing about mining—in the Thetford district, the official was a lawyer—a very respectable gentleman, no doubt, but not in any way qualified to deal with mining questions from a practical or theoretical standpoint; in the County of Ottawa, the inspector, Mr. Viau, he understood was a shoemaker. There was also a good deal of complaint about the infringement of the law respecting the sale of liquor in mining districts. The men could buy the liquor by the bottle from stores, and a good deal of trouble and annoyance had been created. The inspector might be given powers to deal with such cases. Mr. Irvine then made a strong case against the tax on powder magazines. The amount, $150, for a minimum storage of 25 lbs. of powder or explosives of any kind was felt to be excessive and uncalled for. The amount should be minimised. He called attention to the serious menace mining companies had in the case of bush fires. Much loss had been inflicted by the careless and wanton destruction of valuable timber by settlers clearing their bush land. He asked for a more stringent application of the law in this regard.

JAS. KING, M.P.P.—I do not think I can add anything to what Mr. Irvine has said. I take it as the policy of the Government to do everything in their power that will tend to develop the industries of this province, and to do so means to draw capital and capitalists. You must do something to bid for this capital; you cannot do better in the interest of this province than to bid for the capital to develop its mines and minerals. He commended the Act of 1880, the main features of which were fair and equitable to the investor and the producer.

MR. PELLETIER—I think the Province of Ontario has charged a royalty.

MR. B. T. A. BELL—Yes; but Ontario lands are to be granted on the lease system, and royalty is not to be collected for some years after the entry has been made. At all events the law is not retroactive like Mr. Mercier's. The imposition of the tax under the Act of 1891 had created a feeling of insecurity, and capitalists were chary of investing until some assurance had been given that it would be annulled. Every inducement should be given for the investment of capital, and the fewer restrictions the better.

MR. J. BURLEY SMITH said he never in all his experience heard of an inspector collecting taxes. Their duties ordinarily were largely to see that the laws concerning the health of the employés were observed. His company had a good deal of money invested in works at the mine. Last fall the farmers set fire to their bushland, and started a conflagration which was within an ace of completely destroying the buildings. The Government should not only make laws to take money from the miner, but should also legislate to protect and promote their interests. He would suggest that some power be given to the mine inspector to enforce the law already in existence with regard to these bush fires. He should have power to compel the Forest Ranger to carry out the laws. This official had never been at his place, and had paid no attention whatever to his letters calling attention to the wilful destruction of the forest and the danger caused to his buildings thereby.

HON. MR. IRVINE asked that any new legislation might be submitted to the Association for suggestion.

HON. E. J. FLYNN—I am much pleased to meet this delegation and to hear the opinions thus expressed on a question which I have given much thought and study. While of course I cannot voice the views of the Government, or say what it will do, I may say that personally I do not think the mining industries have advanced to that stage when they can be made a source of revenue. Some years ago when framing the Act of 1880, I went very carefully into the matter, and I did not think we could adopt a revenue policy then. I have seen no reason to change that opinion. I am in favor of as liberal a measure as possible to protect both the interests of the mining industry and the revenue of the country. When all is reckoned, very little revenue has been derived from this source in the past. The law I intend to introduce must of course have the concurrence of my colleagues. I will be very pleased to have suggestions from your Association. I am in favor of a measure which will give satisfaction to all.

The Hon. Mr. Irvine having thanked the commissioner and Mr. Pelletier for their very courteous hearing, the deputation withdrew well pleased with the result of the interview.

The Mining Society of Nova Scotia—A Strong Union of the Mining Interests Formed.

Pursuant to the call issued on the 16th of March there gathered in the Halifax Hotel, Halifax, on Wednesday, March 30th, a large number of gentlemen representing the varied mining interests of the Province. Among others present were: Mr. John E. Hardman (Oldham Gold Co.), Oldham; H. S. Poole, F. G. S. (Acadia Coal Co.), Stellarton; Chas. Archibald (Gowrie Coal Co.), Cow Bay; D. J. Kennelly (Sydney and Louisburg Coal and Rail Co.), Sydney, C.B.; J. S. McLennan (International Coal Co.), Sydney, C. B.; A. A. Hayward (Lake View Mining Co.), Waverley; J. D. Austen (South Uniacke Gold Co.), Halifax; R. H. Brown (General Mining Association of London, Eng.), Sydney; Wm Lithgow and J. R. Lithgow (Glace Bay Mining Co.), Halifax; Chas. Fergie (Intercolonial Coal Co.), Westville, N. S.; G. W. Stuart, Truro, N. S.; H. T. Harding, Truro; B. G. Gray, Halifax; B. C. Wilson, Waverley; T. R. Gue, Halifax; Geo. MacDuff, (Palgrave Gold Co.), Waverley; Harvey Graham (New Glasgow Coal and Iron Co., New Glasgow; R. G. Leckie (Londonderry Iron Co.), Londonderry, N. S; H. M. Wylde, Halifax.

The meeting was called to order by Mr. J. E. Hardman, Chairman of the Provisional Committee, who briefly explained the objects of the call and the purposes for which it was proposed to unite the different mining interests of Nova Scotia. The outline proposed was similar to that followed by the Gold Miners' Association, which had had four years' successful experience.

Upon motion, it was resolved that it was expedient to form "The Mining Society of Nova Scotia," and the society proceeded at once to organize. The constitution and by-laws were taken up clause by clause, debated and passed, as follows:—

I. Name.

The organization will be called "The Mining Society of Nova Scotia."

II. Objects.

The object of the Society shall be to mutually benefit and protect its members, by facilitating the interchange of knowledge and ideas and by taking concerted action upon all matters affecting or relating to the Mining Industries of the Province of Nova Scotia, and generally to promote the said industries by all lawful and honourable means.

III. Members.

The Society shall consist of Members, Associate and Honorary Members.

Members shall be persons engaged in the direction and operation of mines and quarries in the Province of Nova Scotia, more particularly mine and mill owners, parties interested in the ownership of mines, mine managers, superintendents and metallurgists.

Associate Members shall be persons not eligible in the foregoing clause, but such persons whom the Society shall deem worthy of admission for membership.

Honorary Members shall be persons eminent in the profession or in the mineral history of the Province.

IV. Officers.

The Officers of the Society shall consist, 1st—of a President; 2nd—Three Vice-Presidents; 3rd—a Secretary; 4th—a Treasurer; 5th—nine members in good standing, who shall act with the other officers as a General Council, five of whom shall constitute a quorum for the transaction of business.

BY-LAWS.

I. Election of Members.

Application for admission to membership shall be signed by not less than three members in good standing and sent to the Secretary. At least three weeks previous to the date of ballot the Secretary shall provide each member with a ballot slip stating the names of the candidates and their endorsers. A member voting shall sign the ballot slip and return it to the Secretary, erasing "aye" or "no" opposite the name of each candidate. At least fifteen votes in favour of any candidate must be cast to elect, and five negative votes to exclude. Members in good standing only shall be allowed to ballot.

II. Fees.

The Membership Fee shall be ten dollars, payable annually in advance at the Annual Meeting of the Society.

III. Election of Officers.

Nominations for officers shall be sent to the Secretary at least one month previous to the date of the Annual Meeting, and election shall be by ballot, as in the case for membership, on a form prescribed by the Council.

Vacancies occurring in the officers or Council of the Society shall be filled by the Council until the next Annual Meeting.

IV. Duties of Officers.

The President shall be Chairman at all meetings at which he shall be present, and in his absence one of the Vice-Presidents. In the absence of a Vice-President the members shall elect a Chairman for that meeting.

The Treasurer shall hold in trust the invested funds of the Society, which shall be deposited in the name of the Society at a bank approved by the Council, and shall present, from time to time, a statement of the Society's accounts. All cheques shall be signed by the Treasurer and countersigned by the Secretary.

The Secretary shall attend all meetings, shall take minutes of the proceedings, shall be responsible for the safe custody of all papers, books and other property of the Society, and, under the direction of the Council, shall conduct the general business of the Society. The salary of the Secretary shall be determined by the Council.

The Council shall have the general control and direction of the affairs of the Society.

V. Meetings.

The Annual General Meeting for the election of Officers, the transaction of the business of the Society and the reading and discussion of papers shall be held in the City of Halifax, N.S., on the second Wednesday in March of each year.

General Meetings for the reading and discussion of papers and for the transaction of business shall be held quarterly at such time and place as the Council may determine.

Special Meetings may be called by the President at any time, or by the Secretary, on the requisition of five members, notice of which shall be mailed by the Secretary to members of the Society. Any special business or subject for discussion shall be specified in the notice convening such meetings, and the Secretary shall give not less than fourteen days' notice thereof to all members of the Society.

No resolution shall be recorded on the minutes for which less than ten votes are cast. No measure shall pass or action be taken in the name of "The Mining Society of Nova Scotia" at any special meeting without the previous sanction of the Council.

VI. Consulting Officers.

The Council shall have power to appoint such consulting Officers as may be thought desirable from time to time, and may vote them suitable remuneration.

VII. Amendments.

Amendments to the by-laws can be made at any regular meeting of the Society, provided a month's notice of the amendment shall have been previously mailed by the Secretary to the members of the Society.

The election of officers was then proceeded with, when the following were chosen for the ensuing year:

President:

Henry S. Poole, F. G. S. (General Manager Acadia Coal Co.), Stellarton, N. S.

Vice-Presidents:

John E. Hardman, S. B. (Oldham Gold Co.), Oldham, N. S.; R. G. Leckie (Manager Londonderry Iron Co.), Londonderry, N. S.; David McKeen, M. P. (Managing Director Caledonia Coal and Railway Co.), Glace Bay, C. B.

Treasurer:

J. R. Lithgow (Sec. Glace Bay Mining Co.), Halifax.

Secretary:

H. M. Wylde, Halifax.

General Council:

Charles Fergie, M.E. (Intercolonial Coal Co.), Westville, N. S.; Charles Archibald (Gowrie Coal Co.), Cow Bay, C. B; R. H. Brown (General Mining Association of London), Sydney, C. B.; J. R. Cowans (Cumberland Railway and Coal Co.), Springhill; B. C. Wilson, Waverley; George W. Stuart, Truro; Harvey Graham (New Glasgow Coal and Iron Co.), New Glasgow; A. E. Sjöstedt (Pictou Charcoal-Iron Co.), New Glasgow; Clarence Dimock (Wentworth Gypsum Co.), Windsor, N. S.

Mr. Poole, upon taking the chair, made a short speech bearing upon the aims and objects of the Society, which was warmly applauded.

Upon motion, the following gentlemen were made

honorary members of the society: Sir Wm. Dawson, Prof. H. Y. Hind, Hugh Fletcher, B.A.; E. R. Fairbault, C. E., and E. Gilpin, jr., Inspector of Mines.

Several matters of detail were then referred to the Council, and it was then announced that the afternoon session would be devoted to the discussion of the question of the increase of the coal royalty.

In the afternoon a goodly number of those interested in coal mining met at 2.30, and after preliminary discussion a sub-committee consisting of Messrs. Poole, McLennan and Franklyn were appointed to confer with the Government and report at the evening session.

The evening session assembled at 8 p.m., and after doing justice to an ample bill of fare, Mr. J. S. McLennan gave a report of the sub-committee on royalties. Speeches were made by Messrs. Archibald, Kennelly, Wade ,MacDuff and others, and the first meeting of The Mining Society of Nova Scotia adjourned until June next, after scoring an unqualified success.

Ontario's Mining Laws.—The Director of Mines Defends the Government's Policy in Relation to Royalties.

The following excerpts from the advanced sheets of Mr. Blue's report, just issued, will be of interest as explaining the local Government's attitude towards its mining lands:—

The price of mining lands under the old Act in the districts north of Lake Nipissing and the French and Mattawa rivers was uniformly $2 per acre, and in districts south it was $1 per acre.

Under the amended Act prices are graduated according to the situation of lands with respect to railway lines and surveyed territory, ranging from $3 to $4.50 per acre in the districts north, and from $2 to $3 in the districts south of Lake Nipissing and the French and Mattawa rivers.

But the new Act also contains a provision which enabled parties who had made application under the terms of the old Act and paid in money thereon, or who as prospectors or explorers had applied for and expended money or labor in proving locations, to acquire lands at the old price and free from royalties and working conditions, upon renewal of application and payment of the purchase money.

The following table shows by districts the area for which patents in fee simple were issued and the amount paid therefor into the treasury of the province for the year ending December 31, 1891:

District.	No. of patents.	Acres.	$
Rainy River	46	6,812	14,020
Thunder Bay	72	17,172	34,936
Algoma	130	29,580	59,519
Nipissing	20	3,364	6,349
Parry Sound and Muskoka	4	365	365
Elsewhere	17	2,096	2,325
Total	289	59,389	$117,514

Under the leasing clause parties may acquire mining lands in the districts north of Lake Nipissing and the French and Mattawa rivers at the rate of one dollar per acre for the first year, and twenty-five cents per year thereafter, and in districts south of those waters at sixty cents per acre for the first year and fifteen cents per year thereafter.

This feature of the Mining Act is a novel one in this province, and in view of the tenure which so generally obtains in Canada and the United States leasehold from the Crown can only be regarded as on trial. So far it has been favorably received by all classes of mining men, as a large proportion of the applications for lands now being received are made under the terms of the leasing clause. Should it for any reason prove unsatisfactory to the holders they are free to change the tenure into fee simple, in which case the payment of the first year's rent would be applied on the purchase money.

In the State of Minnesota the leasing system was adopted three years ago, and is reported as working very satisfactorily alike to leaseholders and the state. In the Australian colonies and New Zealand all mining lands are leased, and the rental is a fixed one, ranging from five shillings to twenty shillings sterling per acre for each year of the term.

The following table shows by districts the area of mining lands for which leases were granted last year under the terms of the new Act, and the amount paid into the treasury for the first year's rent:

District.	No. of leases.	Acres.	$
Rainy River	2	129	129
Thunder Bay	11	1,267	1,267
Algoma	14	1,793	1,793
Nipissing	17	1,529	1,529
Parry Sound	2	205	123
Elsewhere	1	75	45
Total	47	4,998	$4,886

At the present date (March 15, 1892) thirty more leases are ready for execution covering an area of 3,500 acres.

ROYALTY ON ORES AND MINERALS.

The royalty provision has been more severely criticised than any other of the amended Act. It is, indeed, the only one to which strong objection has been taken, and many sins have been laid at its door by the opponents of the clause. But the subject has more than one side, and there has been much misrepresentation.

It has been charged, for instance, that the royalty has destroyed mining operations in the North Shore districts and driven capitalists and miners out of the country.

This assumes that the clause is already in force, and that it affects alike all mining lands, whether the title is in or out of the Crown. The facts are that it does not apply at all to any lands patented previous to the 4th of May, 1891, saving lands patented under the Free Grants and Homesteads Act; and it cannot apply to any lands sold or leased after that date until seven years from the issue of the patent or lease except in the case of mines known to be rich in nickel, and as to these it cannot apply for four years.

It is true that mining has been comparatively slack during the past year, but not in Ontario or Canada alone. In the United States and Great Britain there was a serious depression as an immediate consequence of the failure of large banking houses in both countries in the latter part of 1890 and the beginning of 1891. The falling off in the tonnage of Lake Superior iron ore in 1891, compared with the output of 1890, was greater than the tonnage of all the iron ore ever raised in the Province of Ontario, if not in the whole of Canada.

In Great Britain inactivity continued throughout the year, but in the United States the industry revived in the last six months as a result of the good harvest in that country.

In Canada, and especially in the province of Ontario, we are dependent on foreign capital to open up and work our mines of iron, nickel, gold, silver, phosphate, etc. Our own capitalists are shy of such investments. Except in rare instances they cannot be persuaded to put their money into mines, or blast furnaces, or reduction works, or refining works, or rolling mills. Enterprise of this sort is a thing of growth and education, and inasmuch as hitherto we have had to rely upon British and American capital to buy and develop our mining lands it can readily be perceived how the financial failures of 1890-91 would affect mining operations in our country.

For more than twenty years miners were free from the payment of royalties to the Crown in Ontario, yet during that period the industry did not prosper. Silver mining was stirred into activity at one time, as an indirect consequence of the policy of putting a provincial tax on mining lands, but the iron, copper and gold mines were idle, and the phosphate and gypsum mines were worked intermittently, in a half-hearted way. We had neither capital nor skill to operate them, and the abolition of the royalties does not appear to have offered a new inducement to one or the other.

The discovery of nickel ore in vast quantities in the North Shore districts a few years ago, and the more recent discovery of the value of nickel as an alloy with steel, have done more than anything else to attract attention to the mineral resources of our province, and there is no evidence to show that the royalty clause of the amended Act has kept out skill or capital in so far as this ore is concerned. It probably did interfere with the plans of dealers, some of whom made fortunes by the sale or lease of undeveloped properties acquired under the terms of the old Act, and all of whom were sanguine of making larger fortunes had the Legislature not seen fit to consider the share of the public interests in that portion of the Crown domain as something apart from the interests of individuals.

A boom has been arrested, but not a mining boom. The men who complain most persistently of the Crown royalty are not miners or mining companies; they are persons who lived in expectation of becoming "kings" themselves, with miners and mining companies paying royalty dues to them.

I have in mind one case in which an option sale of three small locations of nickel ore, situated eight or ten miles from a railway, was made to an English syndicate for a consideration of about $120,000 and a royalty of twenty-five cents per ton on a daily minimum of 200 tons of ore. A payment of several thousand dollars was made on the purchase and as much more was spent in exploring the property last summer, when the representative of the syndicate came to the conclusion that the price agreed upon was far too high in view of the terms upon which locations might be procured from other parties or from the Government. An effort was then made to buy the locations from the owners free from royalty terms, but the price demanded (a quarter of a million dollars) led the syndicate to abandon its option, and meantime they have withdrawn from the country.

Numerous instances of this kind might be cited, and there is no doubt but that the system of private royalties is in great favor with mineral land owners of speculative tendencies.

The iron locations on the Atik-Okan river, fifty miles from the nearest railway station, are understood to have been optioned to a Belgian syndicate subject to royalties ranging from twenty to twenty-five cents per ton; another location in Hastings county has been leased subject to a royalty of forty cents; a barytes mine in Lake Superior is leased at twenty-five cents, and a phosphate mine in the eastern part of the province at two dollars per ton, with a fixed minimum output in each case.

It would be easy to lengthen out the list if it was necessary, for the plan of making mineral land a source of revenue to the owner suggests itself naturally; it is the all but universal practice in Great Britain and the United States, as I shall show presently.

Now the rates of royalty provided for in our Act are on a more moderate scale, being three per cent. on silver and copper and nickel, not exceeding two per cent. on iron, and not exceeding three per cent. on all other ores of metals, calculated upon their value at the pit's mouth.

We do not know exactly what this value would be upon the several kinds of ores in Ontario, but in the case of iron ore we have the data furnished by Bulletin 113 of the United States census for 1890, showing the cost of production in the various states and of the value put upon the ore at the mines, based on the output of 1889. The following table gives the figures for a few states and and the whole country, computed for the long ton:

States.	Cost per ton.	Value per ton.
Alabama	$0.82	$0.96
Michigan	2.07	2.70
Minnesota	1.80	2.87
New Jersey	2.74	3.23
New York	1.64	2.49
Pennsylvania	1.10	1.96
Wisconsin	1.78	2.20
United States	1.71	2.30

For the short ton these averages of cost and value would be about one-ninth less, so that the value of ore at the mines of the United States in 1889 was $2.05 per short ton, in Michigan $2.40, in Minnesota $2.55, in New York $2.21, and elsewhere in the same proportion.

On this basis the royalty payable to the province would not exceed five cents per ton as against the royalties of twenty, twenty-five and forty cents per ton which by the terms of contracts are payable to private parties for iron ore.

For the ores of nickel and copper and of silver we have the returns of values made by mining companies to the Minister of Agriculture for the years 1890 and 1891, as required by the Mining Operations Act. These give averages of $7.60 per ton for nickel and copper and $15 for silver per ton, which at the rate provided for in the Act would yield a royalty of about twenty-three cents on the former and forty-five cents on the latter.

In the light of these figures it is perhaps not surprising if the private owners of mining locations should view with a jealous eye the conduct of the Government in reserving a small royalty on ores or minerals taken from lands sold or leased under the amended Act, at the low price fixed in the Act.

On Accidents in Mines.*

By Mr. James Tonge, F.G.S.

The present paper is a very brief one, and has been written simply to reply to a few remarks and comments that have been made as to recent progress in mining; and to questions that have been asked as to whether certain so-called improvements are REALLY such or only *alterations* by which one danger is avoided to some extent by bringing on another.

Dealing with the question of safety lamps, it is said that the safety lamp is a very doubtful improvement. It is pointed out, in the first place, that there never were in former times, when candles only were used, such violent explosions and fearful loss of life. These objectors forget that the conditions of coal mining are so different. They do not allow for increased depths and temperatures, and for greater quantities and higher pessures of fire-damp; nor do they take into account the more extensive workings and proportionately larger bodies of men down the pit at one time. They forget too, or have never learned, the long series of experiments which may be said to have commenced so far back as 1737.

The old type of safety lamp has served the miners well for more than half a century. But now, with greater quantities of air and increased velocities, they are being replaced by lamps better adapted to existing circumstances. And it seems utterly unreasonable and indefensible to say that explosions are due to their *use*, instead of saying they are due to their *misuse or abuse*. If too much reliance is placed upon them; if they are made to do duty where they never were intended; if they are not kept in good order and perfect condition; this should not be charged against the lamp any more than the failure of any other machine should be charged to the machine rather than to the user. But another objection is taken to the safety lamp. It is said that the roof cannot be examined so well with a lamp as with a candle, and that the deaths from falls of roof and sides have not decreased in number in the same proportion as the deaths from other causes. If we examine carefully the report of H.M. Inspector of Mines we find that whilst the deaths from *all causes* have been reduced during the past 40 years from 1 in 219 to 1 in 530 persons employed, the deaths from *falls of roof and sides* have during the same period been reduced from 1 in 661 to 1 in 1,135 of the persons employed; in other words, whilst the proportion of *total deaths* has been reduced to $\frac{2}{3}$ of what it was in 1851, that from *falls* has been reduced to $\frac{3}{5}$, so that though the saving of life from *falls of roof* has not exactly kept pace with the *whole*, there has been a very substantial gain; such a gain as I think ought to dispel the theory that the use of lamps is objectionable in any direction. It appears to the writer that we are within measurable distance of a time when those who have to earn their bread by the sweat of the brow close to such a terrible foe as fire-damp, shall be enabled to do so without fear of any such terrible explosions as the past history of mining has witnessed; and *this* is the great province of the safety

*Read before Manchester Geological Society.

lamp: not the attempt to save only here and there a single life, for that we look to other sources; but to guard against that terrible sacrifice of life which, though it may but seldom become a reality, is at all times a possibility in the absence of a good and perfect lamp.

Mining Explosives.

In one of our recent issues we published an excellent paper on this subject by Mr. Cockson, read before a meeting of the Manchester Geological Society. This was followed up by a discussion at a subsequent meeting, to facilitate which the members had been previously invited to witness a series of "blown out" shot experiments at the works of the Roburite Explosive Company. The object of these were to show the effect of various explosives when the shot was fired into coal dust, in suspension, and air without the admixture of gas, to show the effect of gunpowder shots and shots fired with several explosives of the water cartridge, or safety tamping class, when used without their safety adjunct, and finally to exhibit roburite as an explosive containing in its composition its own safety element, requiring only a small quantity of ordinary pit stemming to bring this element into play, The subject is of so much importance to our Canadian coal producers, that we take the liberty of quoting the following discussion in full from the printed report of the Society's *Transactions*:—

MR. MAWSON gave particulars of the experiments and the results, with different explosives, as follows:

Series No. 1—Coal Dust and Air.

In this series, 4 oz. of each explosive was used, tamped with 4 inches of dry coal dust. About 4 lbs. of fine coal dust was then sifted into the tank, and whilst the dust was in suspension the shot was fired by electricity.

Series No. 2—Coal Gas and Air.

In this series the same quantity of explosive and the same length and quality of stemming was used. Instead of coal dust, coal gas was allowed to issue into the tank for 90 seconds, given approximately at 10 per cent. mixture. The shot was then fired by electricity, the gas meanwhile remaining on to represent a feeder.

Series No. 1.—COAL DUST AND AIR.

No. of Experiment.	Name of Explosive.	Weight used.	Length of Stemming. Coal dust.	Coal Dust used. Quan'ty.	Coal Dust used. Quality.	Flame. Length of 1st.	Flame. Duration of 2nd.	Remarks.
		oz.	inches.	lbs.		ft.	sec'ds.	Temp. Wet. Dry.
1..	Gunpowder (loose)	4	4	4	Wigan 9ft. Sovereign Pit.	12	2	55° 58°. Large volume of flame, bright and then red.
13	Gunpowder	4	nil	nil	Ditto	10	nil	Fired after No. 12, without any fresh dust. Sparks projected.
2..	Gelignite.....	4	4	4	Ditto	6	nil	53° 55°. Bright forked flame. Coal dust floating in the air.
6 .	Gelignite.....	4	4	4	Ditto	12	nil	55° 56°. Enormous volume of bright white flame. No coal dust floating in the air. Evidently a bona fide *explosion* of coal dust.
9..	Gelignite.....	4	4	4	Ditto	9	nil	54° 57°. Partial *explosion*, but not so marked. Some coal dust floating in air.
10..	Gelignite.....	4	4	4	Ditto	9	nil	54° 57°. Bright flame, but not such a broad sheet.
3..	Roburite	4	4	4	Ditto	nil	nil	54° 57°. Cloud of black dust.
7..	Roburite	4	4	4	Ditto	nil	nil	51° 52°. Ditto
11..	Roburite	4	4	4	Ditto	nil	nil	53° 55°. Ditto
4..	Securite No. 2 (coal)	4	4	4	Ditto	8	1½	56° 58°. Dull flame.
5..	Tonite.....	4	4	4	Ditto	5	nil	56° 58°. Dull red flame pointed. Coal dust not fired.
8..	Tonite.....	4	4	4	Ditto	nil	nil	55° 57°. Cloud of black dust.
12	Tonite.....	4	4	4	Ditto	5	nil	50° 54°. Dull red flame, pointed. Coal dust not fired.
14..	Tonite.....	4	4	4	Ditto	5	nil	Ditto. Ditto.

Series No. 2.—COAL GAS AND AIR.

No. of Experiment.	Name of Explosive.	Weight used.	Length of Stemming. Coal dust.	Duration of Gas Issue.	Gas exploded or not.	Length of Flame.	Feeder Ignited or not.	Remarks.
		ounces	inches.	sec'ds.		feet.		
1...	Gunpowder.....	4	4	90	yes	..	yes	Undoubted explosion; difficult to estimate length of flame.
2..	Gelignite.....	4	4	90	yes	..	yes	Ditto ditto
3...	Roburite	4	4	90	no	..	no	Cloud of black dust.
6..	Roburite	4	4	90	no	..	no	Ditto
8...	Roburite	4	4	90	no	..	no	Ditto
4...	Securite No. 2 (coal)	4	4	90	yes	4	yes	Undoubted explosion; difficult to estimate height of flame.
5...	Tonite.....	4	4	90	no	4	no	Dull red flame seen above tank, but no explosion of gas.
7...	Tonite.....	4	4	90	no	..	no	No flame. No explosion of gas.
9..	Tonite.....	4	4	90	yes	..	yes	Undoubted explosion. Large bright flame.

The tank containing the explosive mixture measures 56 cubic feet, and is 3·10 high.

In answer to questions by the President,

MR. MAWSON said the charges were fired with a cannon enclosed in an iron cylinder, with a scale up the side marked in feet to show the height of the flame.

THE PRESIDENT—Were the charges stemmed in the usual way?

MR. MAWSON—We stemmed with four inches of coal dust.

MR. WATTS—Were these experiments conducted solely by the Roburite company, or were they conducted by independent persons?

MR. COCKSON—They were conducted at the Roburite company's works, under the supervision of Mr. Bigg-Wither, the company's general manager. But there were in attendance at the experiments two of H. M. Inspectors of Mines, and it was put to the vote whether further experiments, or what experiments, should be made, in every case, so that all the gentlemen present could ask to have the experiments carried out as they wished. I do not, however, think that any question should be raised as to how they were made, the presence of the gentlemen who where there being quite enough to ensure their being made absolutely without any shadow of prejudice either one way or the other. I see Mr. Saint, who witnessed the experiments, is here.

MR. WATTS—I asked the question in order that the point might be clearly stated, because in experiments of this kind, in which a company is interested, it is necessary that they should be conducted without any show of favouritism. I have no interest in any one particular explosive over another, only I think it desirable that when such experiments as these are made they should be conducted by independent persons.

MR. BIGG-WITHER—I, as general manager of the Roburite company, was asked to carry out the experiments, and no one present raised the slightest question as to their fairness. I asked Mr. Saint, who was there, if he would be kind enough to watch each charge, and Mr. Saint's reply was that he would trust to us.

THE PRESIDENT—I do not think Mr. Watts means to cast any suspicions upon the *bona fide* character of the experiments, but what he means and is perfectly right in saying, is this: Here is a paper read before the Society, and the experiments are, so to speak, got up by some of the members of the Society, and it behoves us as a Society not to put our stamp upon anything that is not absolutely above suspicion. It is only a matter of precaution. There is no suggestion that anything was done that would not have been done whoever was there; it is only to prevent the Society being made use of by a trading concern for its own interest.

MR. WATTS—I am glad the president has put it in that way. That was precisely my view in asking the question.

MR. BIGG-WITHER—And it was in that view I replied to you. I may add that it was our desire that the tests should be absolutely impartial, and for that reason I asked Mr. Saint, one of H. M. Inspectors of Mines—who was present—to see how each shot was charged, and to see that the tests were conducted in conformity with the programme.

MR. DONALD MUNRO—I think there are conditions in connection with blasting which are better known to mining men than they are to Mr. Bigg-Wither.

MR. BIGG-WITHER—It is quite possible.

MR. MUNRO—And it would perhaps have been better if the experiments had actually been conducted by such men as those. I may say I have had some practical experience with regard to blasting with the different explosives that have been mentioned, and I am glad to hear to-day that so many experiments have been conducted without any sign of flame from roburite. I have tried some experiments myself in different parts of the country with that substance, and I am sorry to say I have not been so fortunate. I have seen flame repeatedly from roburite. There is no one who would be more pleased than I should to see and hear of roburite being absolutely flameless, but in some experiments with roburite at the works where it was manufactured in Germany—I do not know whether they are connected with the works in this country.

MR. BIGG-WITHER—No.

MR. MUNRO—In those experiments I distinctly saw flame. I would like to ask whether in the experiments of Saturday last, at Gathurst, there was any made without any stemming being used. I think the putting in of stemming rather delusive. Experiments should be conducted without it. I know that in a mine you do not usually fire shots without stemming, but when you are testing explosives it is not an unfair test, to try them without any stemming. The stemming has a tendency always to prevent flame from being seen.

A MEMBER—The Roburite Company do not claim that it shows no flame without stemming.

MR. MUNRO—All I want is to make it clear that in the roburite experiments which I saw, and had something to do with, and which were conducted in the dark, flame was seen, though there was stemming used.

MR. DEAN—I have had some little experience with explosives during the time I have been connected with the Wigan Coal and Iron Company, and have seen many experiments with roburite, water cartridge, &c, From roburite I have seen flame, or, to speak more correctly, a flash, for it could hardly be called flame. I saw some experiments which Mr. Hilton gave at the Saw Mills, where with a light tamping the flash was visible, but it did not fire the gas in any instance. I have seen the same light underground, but I do not think that in any case it would have fired gas. Our experiments were carried out on a very dark night. With regard to

tamping, I may say we did try a shot that night at the Saw Mills, with roburite without any tamping, and of course it fired the gas; but I do not think that any one down a pit would attempt to fire a shot without first putting some tamping in. Roburite if tamped with only four inches of coal dust (and that is one of the most inflammable substances you can have in a mine) will not light the gas or the dust. We have used tonite at one of our pits, on the Haigh side, to get down coal, and we were troubled with it not exploding at times. The charge lighted and simply fizzed in the hole; it did not explode and did not blow the rock or coal. One case I remember well, in the Wigan Four-foot; they were using a nine-ounce charge, made up of two portions, 6oz. and 3oz., which were fired simultaneously. The 6oz. charge exploded, bringing down the coal. Afterwards the fireman on visiting the place saw a big light, and found that the smaller charge had not exploded, but was simply burning. The heat was so great that it burnt the coal into a cinder. That of course is a very serious matter in a coal pit. So with roburite; when two charges of this have been put in I have known one not to fire, but to be left in the hole unexploded. I have never known it to burn the coal, however. That shows the necessity of gauging the strength of your shot and putting one charge in. It makes it safer for the men to handle. Electrical firing is another very important matter. I may say that at our pits at Standish we fire on an average 80 or 90 shots per night by electricity, and since March 21st we have not had a single missed shot. That, I think, will compare very favourably with the ordinary fuse or anything else. We have had 4,256 shots within that time, and not one has missed.

THE PRESIDENT asked why, at the experiments, on Saturday, carbonite was not among the explosives tested? The testing of tonite and securite was like flogging a dead horse, the practical use of the former for a short time having convinced him that it was a most undesirable thing to introduce into a mine. After an unexploded shot we found the coal absolutely red hot, and had it been left alone we should have had the whole place on fire. He thought, however, that carbonite would hold its own with roburite, and these two should be tested side by side.

MR. MUNRO—I would like to be perfectly fair. I have tried, I think, all the explosives that have been mentioned to-day, and with regard to roburite it is only fair I should state that I have seen less flame from it when used than from any other explosive. I could not go further than that. I cannot as a mining man myself, say that roburite is absolutely flameless, or perfectly safe, though I should like very much to find it so.

MR. SAINT—I attended the experiments at Gathurst. They were conducted about the middle of the day. In the first series there was a cannon sunk vertically in the ground, and surrounding it was a part of a boiler flue, to a height of about 5 feet above the muzzle, the coal dust being shielded from the wind. The explosives were stemmed with coal dust, and coal dust was passed through a sieve into the flue, and then the wires having been connected, at a signal from Mr. Bigg-Wither, the shot was fired. Both tonite and roburite failed to fire the coal dust. The former gave a flame in two or three instances, but I certainly think roburite behaved the best of all, as there was not any flame seen from its explosion. In the gas tests, again, which were conducted in another part of the works, roburite gave off no visible flame nor did it light the gas which was kept on during the time of the experiments. From what I could see I have no hesitation in saying that roburite was certainly the safest explosive tried on that day.

THE PRESIDENT—No doubt.

MR. SAINT—But there is another question in connection with roburite—that is, its effect upon the health of the miners. Mr. Bramall, at a former meeting of this society, gave instances of men having been poisoned, and he attributed the mischief to the use of roburite.

MR. STIRRUP—To the inhaling of roburite fumes.

MR. SAINT—It was a question what did poison the men? Some people said it was the fumes, but others were of opinion that it arose from the men handling the stuff. It was stated in a case of arbitration in which Professor Dixon and one or two other medical gentlemen were deputed to test the fumes arising from the explosion of roburite, that those fumes were less noxious than the fumes of gunpowder. Then the question arises, how were the men poisoned? Did they handle the roburite? Some people say that they did and others that they did not; but I have a theory on the subject. I have been told that in some shots the whole of the roburite charge has not been exploded, and in such cases it is possible that a portion of the charge may have been thrown into the atmosphere and the men may have inhaled it, and thus have become poisoned. I believe it was stated by Professor Dixon that the atmosphere, after a shot of roburite, had been filtered through spun glass, and that a yellow substance had been deposited on the web. I have a great curiosity to know what that yellow substance was. Was it roburite, or could it have been something else? Possibly Mr. Cockson or Mr. Bigg-Wither may be able to throw some light upon the question.

MR. WATTS—With reference to roburite affecting the health of the men using it, I may say that I have had some experience. About two years ago, when this explosive was being introduced, I obtained about 1½ cwt. of it for the purpose of testing it side by side with tonite and gunpowder, in a tunnel which I was engaged in constructing. As an explosive I find roburite about equal to tonite, and the same labour in stemming, &c., is required for the two. In our case we used a double tape fuse—of course this being a tunnel in rock, and not a colliery, we proceeded in a different way to what the colliery people do where fiery gases exist—we used a double tape fuse all through the work; therefore the firing was the same. After a few days' use of the roburite my men began to complain very seriously of a want of energy in their legs, and a peculiar sensation in the roof of their mouths. I asked them if they had put their fingers in their mouths before washing them after using this stuff, and they all declared that they had not; I therefore concluded that the sickness they complained of was due entirely to the fumes given off by roburite. I do not know of anything else that could account for it. I was extremely anxious that roburite should be used because at that time it was 3d. or 4d. per lb. cheaper than tonite, and it was to our interest to use it, as well as to that of the men, because we purchased it in the first instance and sold it to them. The men, too, were equally anxious to use it. There is one little drawback, however, in reference to roburite: that is to say, if they would serve the cartridge in the same way as the tonite is served, the men would have less handling of it, and I think it would encourage its use, if the gentlemen present, representing the Roburite Company, could see their way to do this. It would meet a complaint which I know is made amongst miners. I am speaking, of course, of the men we employ and not of colliers. Doubtless where fumes deleterious to health are generated much will depend upon the ventilation. The ventilation in the case I have referred to was good. It was the same precisely with tonite as with roburite. As an explosive for facilitating and cheapening work I believe there is nothing cheaper than blasting powder. I have taken note of all the explosives we have used in our tunnel, and I know to a shilling the cost per yard; and I have no hesitation in saying that in driving an ordinary sized heading you will drive it with powder and roburite or tonite mixed several shillings a yard cheaper thon all tonite, but the cheapest of all is powder. With powder, however, you require to have good ventilation.

MR. COCKSON, replying upon the discussion, said: With regard to the experiments on Saturday, I hope nobody misconstrued my meaning, when I said that I was sure that all the gentlemen present understood that those experiments were so conducted as to be beyond suspicion. I took that for granted, and I am sure the members of this society will grant it at once; but with regard to the point that it would have been better if the experiments had been conducted by mining men, I think that is sufficiently covered by my saying that the actual charging—the actual work—was done by a couple of under-ground workmen who have been sufficiently trained, and who have fired thousands upon thousands of shots of all the different explosives, and they naturally were very much more suited for the work than any of our own members would be. They knew the precautions to take and the nature of the explosives, and we could not have got through the experiments in three times the time we did if they had been made in any other way than they actually were. As to the fairness of testing explosives without stemming, I am afraid I cannot agree with the gentlemen who spoke. I think that any test as to an explosive should be made as much as possible under the conditions in which you use that explosive in a mine; but I would modify that to this extent. I would make the conditions more onerous in the test than would actually be the case in the mine, so that if you get it proved to be safe with conditions more onerous than you actually can have in actual use, then you may take it for granted that what is proved to be safe in your experiment must be absolutely safe under more favourable conditions. Some experiments were made in South Wales a few months ago with the idea of showing that Carbonite, though unstemmed, would not fire an explosive mixture of gas and air. I was not present at those experiments, but Mr. Bigg-Wither was, and he protested against the experiments being made with the explosive unstemmed. I may say that that opinion is held by myself and nearly all the mining people with whom I have spoken on the subject. These experiments in South Wales simply proved that in an unworkable test—a test which, to my mind, was of no possible value—all the explosives at present on the market, that is, the English market, will fire an inflammable mixture of gas and air if untamped. They proved that undoubtedly; and as far as it goes it is a fact I have myself known for the last three years, and there is nothing new in it. It, I am afraid, proved rather too much for some of the gentlemen who were interested in the experiments because they had hoped that carbonite would not fire gas if untamped; but it did, and we may take it that all the explosives at present known will fire an explosive mixture of gas and air if untamped. I have been asked why the experiments were not made with carbonite, on Saturday. The simple reason for that is stated in my paper. I said I only proposed treating on explosives made and manufactured in England. I did not propose to go through the list of German and French explosives which may be counted by the score, but I confined the details of my paper to explosives really made and manufactured in England. For the president's information, and that of the Society, I may say that my experience of carbonite leads me to think that it may be—I do not say that it is—an explosive that will not inflame gas in actual practice. But it has, to my mind, some very serious drawbacks, which possibly might be shown with the testing machine better than can be described. But though I do not say that carbonite is not a safety explosive, we did not make experiments with it because we have had difficulties in the use of it through its freezing, which caused me personally to decide not to have anything to do with it. There is also the fact of its extreme inflammability. It appears to my mind that these disadvantages will prevent its being largely introduced for underground work. Taking the question raised by Mr. Watts as to the fumes of roburite (and it was also raised by Mr. Saint) the most recent information was given us in the report of the meeting of the Institute of Mining Engineers, held in London, about ten days ago. At the close of a very voluminous report there is a statement of "conclusions and recommendations," and it is stated amongst other things "that the products of the explosions of roburite and tonite are not more deleterious than the products of the explosion of gunpowder," and "with regard to the production of carbon monoxide, the average quantity found is so much dissipated by the air around as to be detected only in traces after an interval of five minutes after the firing of the shot." Upon this is based the recommendation that an interval of at least five minutes should be allowed after the firing of the shot before the hewers re-enter the place. This would preclude any complaint on the question of fumes. Through careless handling poisoning undoubtedly may ensue, but apart from this and the possibility of getting the poison into one's system through cuts, etc., there can be no question that roburite is perfectly safe. I see in this same report they give the proportion of carbon monoxide to tonite, gunpowder, and roburite fumes as follows:—

	Parts.
Tonite	0·55
Gunpowder	0·4
Roburite	0·38

With these facts before us I think we may allow the fumes objection to sink into oblivion. I am glad to find that since my paper was read one of H. M. Inspectors in the South Wales District (Mr. Robson) almost repeats some of the words I used; saying in his annual report to the Home Secretary: "That in the interests of safety, blasting with gunpowder should be abolished in all coal mines known to produce fire-damp, or which are naturally dry and dusty." Mr. Hall, too remarks: "It is perfectly clear that explosives which, although tamped with clay, give off flame, must be discarded altogether." I am glad to find that throughout Lancashire the practice is really in advance of the requirements of legislation in the use of an explosive which will not inflame an explosive mixture of gas and air or a mixture of coal dust and air; and such explosive is being used with the extra precaution that firing is carried on between the shifts, when risk to life and limb is so very much less. I am glad to think that in this district mine owners and managers are doing their best in this respect to keep in advance of legislation, and to minimise the risk of accidents occurring.

THE PRESIDENT—I am much obliged personally to Mr. Cockson for his explanation, and I perfectly see the justice of it. I agree with his paper entirely—everything he says in it—and all I should like him to do is to say that possibly (I am speaking now as an independent member of the Society) there may be another explosive besides roburite which fulfils a good many of the requirements which he lays down as a *sine qua non*, but which he may think has compensating drawbacks, lest it should seem that this Society is recommending roburite as the best explosive.

MR. COCKSON—In the course of the discussion I think we have all been alive to the fact that there is such an explosive as carbonite. I have given you my objections to the use of it. My objections mainly are that it is a most inflammable substance, and that if you get a cartridge and put a fuse into it and light it, it burns for a considerable time like a small tar barrel. I cannot think that an explosive which is so inflammable can be called safe. If what Mr. Dean has described happened to a tonite cartridge it would, I submit, be as likely to happen to a carbonite cartridge; and for that reason alone I prefer not to have anything to do with carbonite.

MR. MUNRO reiterated his belief that a trial without stemming was the only true test of safety. In colliery operations, he said, they met with a good many fissures in the seams, and the stemming was only on one side, whereas the sides and back end might be exposed to one or more of such fissures, and if it was not a safety explosive gas might be fired. He had no faith in the so-called safety envelope. What he would like to see was a self-contained safety explosive, and he hoped that Mr. Bigg-Wither, or some one else, would soon give it them.

MR. COCKSON said he could not agree with the views as to stemming expressed by Mr. Munro. He could not believe that roburite could cause an explosion. The composition of the gas in any cavity or fissure would not allow that. If they bored through into a feeder the workman would certainly hear the issue of the gas, and he would not be so foolish as to fire a shot in a hole where gas was issuing; and if there was the least thickness of coal between the shot hole and such fissure, it would be a sufficient protection to ensure the quenching out of the small flame that was caused by the explosion of a roburite shot.

A New Alloy.—Professor Austin gives the Royal Society of Great Britain an account of his discovery of a new alloy of gold and aluminum, which is said to be the most brilliantly colored combination yet made. It has a fine purple color, with ruby tints, where the light is reflected from one surface of the alloy to the other.

The Spontaneous Ignition of Coal, and its Prevention.*

By Vivian B. Lewes, F.I.C., F.C.S.

Last autumn I had the honour of bringing before the chemical section of the British Association certain views, which are now widely gaining ground, as to the cause of the phenomenon of spontaneous ignition in masses of stored coal; and, in the discussion which ensued, Sir Frederick Bramwell expressed the hope that the paper would be followed by a second, in which methods for the prevention of this too often disastrous action might be discussed; and it is at the invitation of your secretary that I propose to bring my views on the subject before you to-night. Ever since the general adoption of coal as a fuel, the storing and shipment of masses exceeding 2,000 tons has been recognized as requiring great care; and if much small coal has been present, or if it has been stored wet, firing, or at any rate heating, of the mass, has frequently taken place. On shore this has led to much inconvenience and loss, but it is during shipment that the real danger has occurred; and many a fine vessel, with all hands, has been lost from this cause, without even a record of the calamity reaching the land. In 1875, the loss of life and property from this cause became so serious, that a royal commission was appointed to report upon the possibility of preventing these appalling disasters; but the recommendations contained in the report, although of the greatest possible value, seem to have had but little effect in checking the loss from spontaneous ignition; and, in the nine years following the publication of the report (1873 to 1883), no less than 57 coal-laden vessels are known to have been lost from this cause, whilst 328 others were missing. In coal stores, and in gas works, heating frequently takes place, but is so much more easily dealt with than at sea, that cases of absolute ignition are much rarer; and it is from the evidence obtained in the case of coal cargoes, that we can learn most as to the cause and prevention of this most dire plague of the coal trade.

In treating the subject to-night, I will first bring to your notice the explanation of the action which eventually results in combustion, and which is founded upon the work of Richters and myself, and will consider how the incipient action can be best prevented, or at least retarded, and the steps which should be taken in case ignition should result. Coal is a substance of purely vegetable origin, formed out of contact with air by long exposure to heat and pressure from the woody fibre and resinous constituents of a monster vegetation, which flourished long before the earth was inhabited by man; and coal may be therefore looked upon as a form of charcoal, which, having been formed at a temperature lower than that of the charcoal burner's heap, and under great pressure, is very dense, and still retains a quantity of those constituents which, in the latter case, are driven off as tar, wood naphtha, &c. These bodies consist essentially of compounds containing carbon and hydrogen, together with a little oxygen and nitrogen, and form the volatile matter and hydrocarbons of the coal. Besides the carbon and hydrocarbons, coal also contains certain mineral bodies, which were mostly present in the sap and fibre of the original vegetation, and which gives the ash which is left behind when the coal is burnt. These substances consist chiefly of sulphate of lime or gypsum, silica, and alumina, whilst in nearly all kinds of coal is to be found a substance called disulphide of iron, coal brasses, or pyrites, which has been formed by the gradual reduction of the sulphates by carbonaceous matter in the presence of iron salts, and which during the combustion of the coal, is decomposed, giving off sulphur compounds, and leaving behind oxide of iron, which gives the reddish brown colour to the ash of many kinds of coal. Of these constituents of coal, the only ones which play no part in the phenomena attending heating and spontaneous ignition, are the mineral constituents other than the pyrites, and we have, therefore, to deal with the chemical actions which take place when the carbon, hydrocarbons, and brasses contained in newly-won coal come in contact with air and moisture.

A.—THE INFLUENCE OF CARBON IN PRODUCING HEATING.

Carbon is one of those substances which possess to an extraordinary degree the power of attracting and condensing gases upon their surface, this power varying with the state of division of the particular form of carbon used. The charcoal obtained from dense forms of wood, such as box, exhibits this property to a high degree, 1 cubic inch of such charcoal absorbing—†

Ammonia gas	90	cubic inches.
Sulphuretted hydrogen	55	"
Carbon dioxide	35	"
Ethylene (olefiant gas)	35	"
Oxygen	9·25	"
Nitrogen	6·5	"

while certain kinds of coal also exhibit the same power, although to a less degree. The absorptive power of newly won coal due to this surface attraction varies, but the least absorbent will take up one and a quarter times its own volume of oxygen, while in some coals more than three times their volume of the gas is absorbed. This absorption is very rapid at first but gradually decreases, and is, moreover, influenced very much by temperature, for reasons which will be explained later. The absorption is at first purely mechanical, and itself causes a rise of temperature, which, in the case of charcoal formed in closed retorts, as in preparing alder, willow, and dog-wood charcoal for powdermaking, would produce spontaneous ignition if it were not placed in sealed cooling vessels for some days before exposure to air.

The rate of absorption varies with the amount of surface exposed, and therefore able to take part in this condensing action, so that, when coal or charcoal is finely powdered, the exposed surface being much greater, absorption becomes more rapid, and rise of temperature at once takes place. If, after it has been made, charcoal is kept for a day out of contact with air, and is then ground down into a powder, it will frequently fire after exposure to the air for thirty-six hours, whilst a heap of charcoal powder, of 100 bushels or more, will always ignite. It is for this reason that in making charcoal for powder, it is always kept, after burning, for three or four days in air-tight cylinders before picking over, and ten days to a fortnight before it is ground. In the case of coal, this rise in temperature tends to increase the rate of the action which is going on, but is rarely sufficient to bring about spontaneous ignition, only about one-third the amount of oxygen being absorbed by coal that is taken up by charcoal; the action also being much slower, tends to prevent the temperature reaching the high ignition point of the coal. Air-dry coal absorbs oxygen more quickly than wet coal.

B.—THE ACTION OF THE BITUMINOUS CONSTITUENTS OF THE COAL IN SPONTANEOUS IGNITION.

All coal contains a certain percentage of hydrogen, which is in combination with some of the carbon and also with the nitrogen and oxygen, and forms with them the volatile matter in the coal. The amount present in this condition varies greatly, being very small in anthracite and very great in cannel and shale. When the carbon of the coal absorbs oxogen, the compressed gas becomes chemically very active and soon commences to combine with the carbon and hydrogen of the bituminous portions, converting them into dioxide and water vapour. This chemical activity increases rapidly with rise of temperature, so that the heat generated by the absorption of the oxygen causes it to rapidly enter into chemical combination. Chemical combination of this kind—*i.e.*, oxidation—is always accompanied by evolution of heat, and this further rise of temperature again increases rapidity of oxidation, so that a steady rise of temperature is set up, and this taking place in the centre of a heap of small coal, which, from the air and other gases enclosed in its interstices, is an admirable non-conductor of heat, will often cause such heating of the mass that, if air percolate slowly into the heap, in sufficient quantity to supply the necessary percentage of oxygen for the continuance of the action, the igniting point of the coal will soon be reached. The effect of rise of temperature in increasing the rapidity of chemical actions of this kind can be realized from the effect which it has in the spontaneous ignition of oily waste or rag.

If a substance like cotton waste be rendered oily with anything except the mineral oils, it acquires the power of taking up oxygen from the air, and this oxidising the oil gives rise to heat. At ordinary temperatures this oxidation is slow, and, consequently it may be days before the rise in temperature becomes sensible, but when this point is reached the oxidation proceeds with remarkable rapidity, and in a few hours the point of ignition is reached, and the mass bursts into flame, whilst if the oily waste be placed in a warm place at first, spontaneous ignition is only a question of hours, or sometimes even minutes. Galletley found that oily cotton at ordinary temperatures took some days to heat and ignite, whilst, if placed in a chamber warmed to 130° to 170° Fahr. (54° to 76° C.), the cotton, greasy with boiled linseed, ignited in one hour and fifteen minutes, and olive oil on cotton in five hours; and in a chamber heated to 180° to 200° Fahr. (82° to 93° C.) olive oil on cotton ignited in two hours. It has been suggested that very bituminous coal, such as cannel, shale, and coals containing schist, is liable to spontaneous ignition, from the fact that a rise in temperature would cause heavy oils to exude from them, which, by undergoing oxidation, might cause rapid heating. But experiment not only shows that this is not the case, but that the heavy mineral oils have a remarkable influence in retarding heating; cotton waste, oily with easily oxidisable oils mixed with 20 per cent. of heavy mineral oil, being exempt from heating.

C.—THE ACTION OF IRON DISULPHIDE, PYRITES, OR COAL BRASSES IN PROMOTING SPONTANEOUS IGNITION.

The earliest theory as to the cause of spontaneous ignition in coal was, that it was due to the heat given out during the oxidation of pyrites (the disulphide of iron) into sulphates, and this idea has been adopted, and has held its own, in this country up to the present time, although the researches of Dr. Richters, some twenty years ago, clearly prove that the explanation was an erroneous one, and the late Dr. Percy, as early as 1864, pointed out that probably oxidation of the coal had a great deal to do with the action. This disulphide of iron is found in coal in several different forms, sometimes as a dark powder distributed throughout the mass of the coal, and scarcely to be distinguished from coal itself. In larger quantities, it is often found forming thin golden-looking layers in the cleavage of the coal, while it sometimes occurs as masses and veins, often an inch or two inches in thickness, but inasmuch as these masses of pyrites are very heavy, they rarely find their way into the screened coal for shipment, many hundreds of tons of these "brasses" being annually picked out from the coal at the pit's mouth, and utilized in various manufacturing processes. The yellow pyrites which form the large masses in the coal, and even the dark varieties when in the crystaline form, remain practically unaltered, even after long exposure to moist air, but the amorphous and finely divided portions, which probably contain lower sulphides mixed with the disulphide, will oxidise and effloresce with considerable rapidity when exposed to moisture and air, forming mixtures of ferrous sulphate and basic sulphates of iron, and it is during this process of oxidation that the heat supposed to bring about the ignition of the coal is generated.

In some of the coals most prone to spontaneous ignition there is only 0.8 per cent. of pyrites, and if we imagined the whole of this to be easily oxidisable, and to be concentrated in one spot instead of being spread throughout the mass, and to be entirely oxidised in a few hours, the rise of temperature would only be a few degrees; whereas, under existing circumstances, it is manifest that practically no determinable increase can be generated by the action. Under certain conditions the oxidation of masses of pyrites first gives rise to the formation of ferrous sulphate, and sulphur dioxide with liberation of sulphur, and my early experiments led me to believe that, inasmuch as sulphur has an igniting point of 250° C., this free sulphur might play an important part in the action, by lowering the point of ignition; later experiments, however, show that this could only take place with large masses of pyrites undergoing oxidation, and that with the amounts present in coal, if the air were present in sufficient quantity to oxidise the pyrites, the small trace of sulphur liberated would be oxidised to sulphur dioxide at temperatures as low as 60° C. This oxidation of sulphur at low temperatures is not a generally known action, but my experiments show that it takes place with considerable rapidity. The only way in which pyrites can assist spontaneous ignition is that when they oxidise they swell, and cause disintegration of the lumps of coal, so exposing fresh surfaces to absorb oxygen and afterwards carry on chemical action. I have carefully determined the igniting point of various kinds of coal, and find that—

Cannel coal	ignites at	698° Fahr.	=370° C
Hartlepool coal	"	766	=408
Lignite "	"	842	=450
Welsh steam coal	"	870·5	=477

So that no stretch of imagination could endow the small trace of pyrites scattered through a large mass of coal, and undergoing slow oxidation, with the power of reaching the needful temperature. When coal is heating, it gives out a distinctive and penetrating odour, which is the same as that noticed when wood is scorched. The gases evolved by the heating coal consist of nitrogen, water-vapour, carbon dioxide, carbon monoxide, hydrocarbons of the paraffin series, and sulphuretted hydrogen, the presence of the latter gas showing beyond doubt that oxidation of sulphur had nothing to do with the action.

We can now trace the actions which cumulate in ignition. The newly-won coal is brought to the mouth of the pit, and at once commences, by virtue of its surface action, to absorb oxygen from the air; but unless piled in unusually large heaps and a great deal broken, it does not, as a rule, show signs of heating, as the exposed surface is comparatively small, and the air finding its way freely between the lumps keeps down the temperature. The coal is now screened, and the obtrusively large lumps of brasses picked out; it is then put in the trucks, and enjoys the disintegrating processes of joltings and shuntings innumerable, every jar adding to the percentage of small coal present, and a corresponding increase in the size of the surface exposed to the air. Arrived at the docks, it has to be transferred from the truck to the ship, which is done by one of the numerous forms of tips, shoots, or spouts employed for the purpose, and it is during this operation that more harm is done than at any other period. The coal first shot into the vessel, by reason of the distance which it has to fall, is broken down into small lumps, and having to bear the impact of the succeeding load falling upon it from a height, rapidly becomes powdered into slack, whilst the succeeding loads falling in on the cone so formed get more or less broken down, so that, by the time the cargo is all taken in, a dense mass of small coal is found under the hatchway, and it is invariably at this point that heating takes place, as the large surface exposed fresh to the air by the breaking down of the coal causes rapid absorption of oxygen, and consequent rise of temperature. This sets up chemical combination between the oxygen absorbed by the coal and the hydro-carbons and coal brasses. On examining the evidence to be obtained as to the conditions under which spontaneous ignition of coal in ships usually takes place, it is found that liability to ignition increases with :—

1. *The Increase in Mass of Coal.*—Thus in cargoes of under 500 tons the cases reported amount to a little under ¼ per cent. for shipments out of Europe; from 500 to 1,000 tons, to over 1 per cent.; from 1,000 to 1,500 tons, to 3·5 per cent.; 1,500 to 2,000 tons to 4·5 per cent.; and over 2,000 tons to no less than 9 per cent. The evidence demonstrating this very remarkable result is to be found in the Report of the Royal Commission for 1875, p. 8, and clearly shows the influence of mass upon this action, which acts in two ways :—(*a*) The larger the mass, the more non-conducting material will there be between the spot at which heating is taking place and the cooling influence of the outer air. (*b*) The larger the

* Paper read before the Society of Arts, March 2, 1892.

† Stroke.

mass the greater will be the breaking-down action of the impact of coal coming down the shoot upon the portions first loaded into the ship, and the larger, therefore, the fresh surface exposed to the action of the air.

2. *The Ports to which Shipments are Made.*—Of 26,631 shipments to European ports in 1873, only ten resulted in casualties, while 4,485 shipments to Asia, Africa, and America gave no less than sixty. This startling result is partly due to the length of time the cargo is in the vessel, the absorption and oxidation being a comparatively long action; but a far more active cause is the increase in the action brought about by the increase of temperature in the tropics, which converts a slow action into a rapid one, and if statistics had been taken, most of the ships would have been found to have developed active combustion somewhere about the neighborhood of the Cape, the action developed in the tropics having raised the temperature to the igniting point of the coal by that time.

3. *The Kind of Coal*, some coals being specially liable to spontaneous heating and ignition. This is a point on which great diversity of opinion exists, but I think it will be pretty generally admitted that cases of heating and ignition are more frequent in coals from East Coast ports than in shipments of the South Wales coals. The idea that the percentage of pyrites present is any indication of the liability to spontaneous combustion must be entirely discarded, as experiment shows that many coals poor in pyrites frequently ignite, while others rich in them are perfectly safe. A much surer guide is to be found in the quantity of moisture present in an air-dried sample of coal, which is a sure index to the absorptive power. The higher the amount of moisture held by the coal, after exposure for some time to dry air, the greater will be its power of absorption for oxygen, and the greater therefore its liability to spontaneous heating and ignition. This is beautifully shown by the following table, in which the percentage of pyrites and moisture present in some coals is contrasted with their liability to self-ignition :—

Liability to Spontaneous Ignition.	Pyrites.	Moisture.
	Per cent.	Per cent.
Very slight.....	1·13	2·54
	1·01 to 3·04	2·75
	1·51	3·9
Medium	1·2	4·5
	1·08	4·55
	1·15	4·75
Great....	1·12	4·85
	0·83	5·3
	0·84	5·52
	1	9·01

The percentage of moisture shown in this table is not due to external wetting, but is moisture absorbed from the air and held by the coal, so that the amount of it present is an indication of the power of absorption possessed by the coal, and which will give it the power of taking up oxygen as well as water vapour.

4. *The Size of the Coal*, small coal being much more liable to spontaneous ignition than large. This, as has been pointed out, being entirely due to the increase in active absorbent surface exposed to the air, a fact which is verified by the experience of large consumers of coal on land; gas managers recognizing the fact that coal which has been stamped down or shaken down during storage being more liable to heat than if it has been more tenderly handled, the extra breakage causing the extra risk.

5. *Shipping or Storing Coals while wet.*—The effect of moisture upon coals is very remarkable. At first external wetting retards the absorption of oxygen by the coal, but the presence of moisture afterwards increases the action of the already absorbed oxygen upon the hydrocarbons of the coal, and so causes a serious increase in the heating. Of late years the researches of Cowper, Baker, Dixon and others have shown so fully the important part which moisture plays in chemical combination, that it is now fully recognized as a factor of importance in actions of this time. During last autumn, a very marked case of the influence of moisture in the action taking place came under my notice :—A ship took in a cargo of coal at a South Welsh port, the weather being fine and dry whilst she was loading at the main hatch, and wet whilst taking in the coal at the after hatch, with the result that the temperature after the first few days was uniformly about 10° higher in the coal that had been loaded wet than in the dry portion of the cargo, spontaneous ignition being the ultimate result.

6. *Ventilation of the Mass of Coal.*—The so-called ventilation, which has from time to time been introduced into coal ships, is undoubtedly one of the most prolific causes of spontaneous ignition. For ventilation to do any good, cool air would have to sweep continuously and freely through every part of the cargo, a condition impossible to attain, whilst anything short of that only increases the danger, the ordinary methods of ventilation supplying just about the right amount of air to create the maximum amount of heating. The reason of this is clear. A steam coal absorbs about twice its own volume of oxygen, and takes about ten days to do it under favorable conditions, and it is this oxygen which, in the next phase of the action, enters into chemical combination, and causes the serious heating. A ton of steam coal occupies 42 to 43 cubic feet, and if properly loaded contains between the lumps, as nearly as possible, 12 cubic feet of air space, that is to say, of the 42 cubit feet 12 cubic feet is air, and 30 cubit feet is coal. Thirty cubic feet of coal, with its fresh absorbing surfaces laid bare by the crushing incidenial to loading, will, in the first ten days after being taken on board, absorb 60 cubic feet of oxygen, if it can get it. Now, air contains, only, roughly, one-fifth of its volume of oxygen,, so that 60 cubic feet represent 300 cubic feet of air. or twenty-five times as much as is present. It is therefore evident that if air could be excluded, there would be only one twenty-fifth the quantity of oxygen present that is needed for complete action, and any heating would, in consequence, be very slight ; whilst to produce the greatest heating it would be necessary to change the entire air in the cargo twenty-five times in the first ten days, and this is just about what the old method of taking a box shaft along the keelson with venetian lattice upshafts from it would give. The most forcible illustration of the evil of such ventilation is to be found in the case of the four colliers *Euxine*, *Oliver Cromwell*, *Calcutta* and *Corah*, which were loaded at Newcastle under the same tips at the same time, with the same coal from the same seam. The first three were bound for Aden, and were all ventilated. The *Corah* was bound for Bombay, and was not ventilated. The three thoroughly ventilated ships were totally lost from spontaneous ignition of their cargo, whilst the *Corah* reached Bombay in perfect safety.

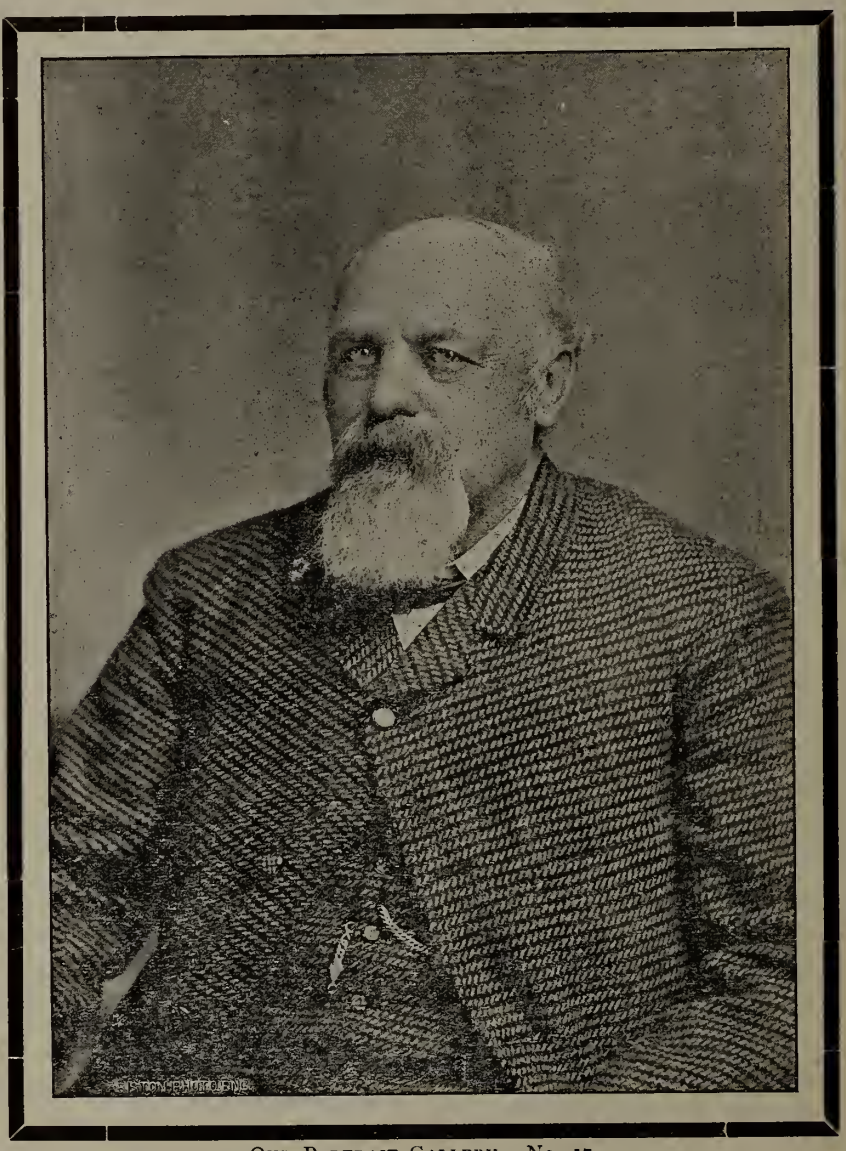
7. *Rise in Temperature.*—It has been fully pointed out that anything which tends to increase of initial temperature increases the rapidity of chemical action ; and in most cases of spontaneous combustion of coal stored in this country, the cause can be traced to a steam pipe or boiler-flue in contact with the mass of coal, or even fixed to a wall against which, on the other side, the coal is heaped. Sometimes the coal store is close to the benches of retorts in a gas-works, or even against the wall of the benches, and in such cases, with certain classes of coals, ignition would be almost certain to take place. In a paper read at the last meeting of the Gas Institute, it was proposed to lead the flues from the benches under the coal store in order to dry the coal, a device which would infallibly lead to spontaneous ignition. On colliers there are many causes for increased temperature, amongst them being the introduction of triple-expansion engines and high-pressure boilers. Steam at 80 lb. boiler pressure has a temperature of 324° Fahr. (162° C.), and a common stoke-hold temperature, with boilers worked at this pressure, is 100° to 130° Fahr. (or 38° to 54° C.). Steam at a boiler pressure of 155 lb. has a temperature of 368° Fahr. or 186° C., and gives a corresponding increase of temperature in the stoke-hold and other adjacent portions of the vessel, the temperature in the stoke-hold under these conditions being from 110° Fahr. (43.5° C.) to 140° Fahr. (60° C.), an increase of about 10° Fahr. Then, again, donkey boilers will often be found recessed into bunker bulkheads, and steam pipes led alongside the bulkheads, with the cargo close up against them on the other side. The effect of temperature due to climatic influences has already been dealt with under the influence on ignition of ports to which shipments are made.

Having now discussed the chemical and physical conditions which lead to the phenomenon known as "spontaneous ignition," we can formulate precautions which will tend to prevent such disasters.

1. *The Choice of Coal for Storage or Shipment.*—The coal should be as large as possible, free from dust, and with as little "smalls" as can be helped. It is better as free from pyrites as possible, and it should contain, when air-dried, not more than 3 per cent. of moisture.

2. *Precautions to be taken in Storing or Loading.*—The coal store should be well roofed in, and have an iron floor bedded in cement, all supports passing through and in contact with the coal should be of iron or brick ; if hollow iron supports are used, they should be cast solid with cement. The coal must never be loaded or stored during wet weather, and the depth of coal in the store should not exceed eight feet, and should only be six where possible. Under no condition must a steam or exhaust pipe or flue be allowed in or near any wall of the store, nor must the store be within twenty feet of any boiler, furnace, or bench of retorts. No coal should be stored or shipped to distant ports until at least a month has elapsed since it was brought to the surface. Every care should be taken during loading or storing to prevent breaking or crushing of the coal, and on no account must a large accumulation of small coal be allowed. These precautions, if properly carried out, would amply suffice to entirely do away with spontaneous ignition in stored coal on land, and we have now to consider a far more important phase of the question.

3. *Precautions to be taken on board Coal-laden Ships.*—This phase of the question is undoubtedly the most important, and in order to ensure any successful treatment of the coal cargo at sea, to prevent undue heating and ignition, the means adopted must be as nearly automatic in their working as possible, as it is useless to expect the master or any officer on board a collier during rough weather, &c., to comply with any instructions, such as daily taking the temperatures in various parts of the cargo, and so on. The iron bulkheads dividing the coal storage from the other parts of the vessel should be made double, and spaced six inches to a foot apart, with openings (which could be closed water-tight) every few feet, to allow of the interior being from time to time coated with protective compositions. Through this double casing sea-water would be allowed to circulate, and would not only effectually prevent any penetration of heat from the stoke-hold, boilers, or engine-room to the coal, but also to do away with any chance of leakage of gases from the coal cargo into other portions of the vessel, and so would minimise the danger of explosions. A similar double partition should run down the centre of that portion of the vessel in which the coal was stored, and it would be sufficient if this were packed with silicate wool ; this partition would serve to prevent any heating which might take place in one part of the cargo being communicated to the other half, whilst it would also perform the important function of helping to prevent shifting of the cargo during heavy rolling. When the coal has all been taken in, it should be battened down, and the hatches should not be again opened until the vessel reaches her destination, the only ventilation allowable being a 2-inch pipe just inserted into the crown of each coal compartment, and led twelve feet up the nearest mast, the top being left open. This would be quite sufficient to allow free egress to any gases



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THE LATE CAPT. TOM SHERIDAN,

Manager Bell's Asbestos Co., Thetford, Que.

DIED, 12th FEBRUARY, 1892.

evolved by the coal, but would not allow undue excess of air. Into the body of the coal cargo itself would be screwed, at regular intervals of about ten feet, iron pipes, closed at the bottom, and containing alarm thermostats, so arranged that when a rise of temperature causes expansion of the mercury in rising in the tube, it makes a contact ; and the wires from these tubes are in connection with an electric bell, index-board, and battery in the captain's room ; so that the moment the temperature is reached to which the thermometers have been set the bell rings, and will continue to ring, until the temperature again sinks, the spot in which heating is taking place beng indicated by the index-board.

In the evidence given before the commissioners in 1875, Mr. J. Glover strongly advocated the use of carbon dioxide, or carbonic acid gas, as it is more usually termed, for extinguishing ignition when it had broken out in a coal cargo, and for stopping heating when it had reached a dangerous pitch. His proposal was to generate the gas by the action of hydrochloric acid upon chalk, and to lead it by gas pipes to the compartment affected ; and this gas, being heavier than air, and a non-supporter of combustion, was to displace the air and its contained oxygen, and so to prevent further action by surrounding the coal with an atmosphere which could not carry on combustion. The idea was a good one, but there were many difficulties in the way of carrying it out, one being that for every 1,000 tons of coal carried, 80 cwt. of hydrochloric acid would have had to be shipped ; also the gas could not have been driven down into the hold if any serious heating had taken place, as an up-current would have been formed, and would have carried it away ; whilst in the state of gas, it fails to give any great cooling effect, and so would have exercised but little influence upon the mass of red-hot fuel. These objections weighed so strongly with the commissioners, that, in their final report, we find the following sentences :—

"Several methods for generating carbonic acid gas, and applying it to the ignited portion of a coal cargo, have been proposed for our consideration. We consider, however, that although this gas might be useful for excluding atmospheric air (which is essential to support combustion), yet it will not, as water does, exert any very sensible cooling effect, *which is a point of vital importance in the case of a mass of ignited coal.* We are of opinion that water and steam are the only agents practically available for the purpose of extinguishing fire in coal cargoes."

Applied in the way which was suggested, there is no doubt but that the carbonic acid gas would have been practically useless ; but there is another way in which it could be used, which would make it a most powerful cooling agent, an instantaneous quencher of fire, and would prevent any further tendency to heat on the part of the coal treated with it. If carbonic acid gas is compressed under a pressure of 36 atmospheres at a temperature of 32° Fahr. (0° C.), it is condensed to the liquid state, and can be obtained in steel vessels closed with screw valves. On opening the valve some of the liquid is ejected into the air, and in coming into the ordinary atmospheric pressure, is in a moment converted into a large volume of gas. Conversion from the liquid to the gaseous state means the absorption of a large amount of heat ; and so great is this, that everything near the stream of new-born gas is cooled down, and some of the escaping liquid is frozen to a solid, having a temperature of −78 C., or −108·4 Fahr. This liquid carbonic acid gas is now extensively manufactured, and is used abroad to a large extent for ærating waters, driving torpedoes, and for freezing machines ; and I should suggest its use in the following way for the checking of ignition in the coal cargo. The nozzle attached to the screw-valve on the bottle of condensed gas should have a short metal nose-piece screwed on to it, the tube in which should be cast in solid, with an alloy of tin, lead, bismuth and cadmium, which can be so made as to melt at exactly 200° Fahr. (93° C.). The valve should then be opened, and the steel bottle buried in the coal during the process of loading. The temperature at which the fusible metal plug will melt is well above the temperature which could be reached by any legitimate cause, and would mean that active heating was going on in the coal ; and under these conditions the pressure in the steel cylinder would have reached something like 1,700 lbs., and the moment the plug melted, the whole contents of the bottle would be blown out of it into the surrounding coal, producing a large zone of intense cold, and cooling the surrounding mass to a comparatively low temperature. The action, moreover, would not stop here, as the cold, heavy gas would remain for some time in contact with the coal, diffusion taking place but slowly through the small exit pipe.

When the coal has absorbed as much oxygen as it can, it still retains the power of absorbing a considerable volume of carbonic acid gas ; and when coal has heated, and then been rapidly quenched, the amount of gas so absorbed is very large indeed, and the inert gas so taken up remains in the pores of the coal, and prevents any further tendency to heating ; indeed, a coal which has once heated, if only to a slight degree, and has then cooled down, is perfectly harmless, and will not heat a second time. It is not by any means necessary to replace the whole of the air in the interstices of the coal with the gas, as a long series of experiments show that 60 per cent. of carbonic acid gas prevents the ignition of the most pyrophoric substances. One hundred cubic feet of gas can be condensed in the liquid state in a steel cylinder one foot long and three inches diameter, and it has been shown that a ton of coal contains air spaces equal to about 12 cubic feet ; therefore one of these cylinders would have to be put in for every eight tons of coal, as, although the gas formed at the first moment would only occupy a small space, on account of its low temperature, it would rapidly expand in contact with the hot coal. These cylinders should be distributed evenly throughout the cargo, and near the alarm thermometers, which should be set to ring a degree or two below the point at which the fusible plug would melt. The bell ringing in the captain's room would warn him that heating was taking place, and the bell would continue to ring until the cylinder had discharged its contents, and had cooled the cargo down to a safe degree, so that the whole arrangement would be purely automatic, and yet the officers would know if everything was safe. This liquid is now being made at a comparatively cheap rate, and, with any demand for it, machinery could be put up at the principal coaling ports, to charge empty cylinders at a very low rate, so that the initial cost of the steel cylinders once got over, the expenses would not be worth considering, more especially as one, or two at most, of the cylinders in use, would be likely to go off. If the precautions advocated were taken, no danger could arise until the arrival of the ship at her destination, and the commonest precautions would then suffice. On removing the hatches, no naked light must be allowed near them, and no one must be allowed to descend into the hold until all the gases have had time to diffuse out into the air. If the cylinders have gone off, there will be but little fear of explosion, as a high percentage of the carbonic acid gas lowers the explosive power which the mixture of marsh gas (given off from some coal) and air possess ; but the carbonic acid gas would overcome and suffocate a man descending into an atmosphere containing any considerable percentage of it. When a safety lamp, lowered into the hold, continues to burn as brightly as it did in the open air, then it is perfectly safe to descend.

When once coal in a cargo has fired, pumping in water is practically of no use, as the fire is as a rule, near the bottom of the mass of coal, and the flow of water is so impeded by the caking of the heated mass above the fire, that in percolating through the interstices of the heated coal, it is converted into steam before it can reach the seat of combustion. The most effective way to apply water would be to have three-inch pipes laid along the floor of the coal compartments, about six feet apart, these tubes having a quarter-inch bored in the upper side every foot or so, and each pair of pipes coming through the bulk-head, and connecting on to two six-inch pipes passing through the side of the vessel, the sea water being prevented from entering by means of screw valves. As soon as the alarm thermometer gave notice that heating had reached a dangerous point, these valves could be opened and the lower portion of the cargo drenched with salt water. This, evaporating rapidly, would give large volumes of water vapour, which, passing up through the heated coal, would lower its temperature, but would not be nearly as effective as the method before advocated. It might, however, be used in conjunction with that method, and would, in many cases, save the carbonic acid gas. In the case of coal bunkers in modern steamers and warships, the conditions under which the coal is placed are so totally different from those existing in a collier, that no comparison can be drawn between them. In the coal bunker, the question of mass, which which plays so important a part in a hold laden with coal, is almost entirely eliminated, as 50 to 400 tons would be about the capacity of any ordinary bunker, and it has been before shown that the cases of spontaneous ignition in masses of coal less than 500 tons does not amount to more than quarter per cent., and the question of initial temperature becomes the most important factor.

To be Concluded.

Cast Iron.

The fourth of a series of lectures on this subject was delivered recently by Mr. Thomas Turner at the Mason College, Birmingham. The lecturer stated that castings were sometimes made from iron taken directly from the blast-furnace, in the fluid condition. But this method was only used to a very limited extent, and was becoming relatively of less and less importance as irregular results were obtained, owing to the variations in the character of the iron made in a blast-furnace from day to day, or even from hour to hour. So that even when founders are also ironmakers it is the custom to remelt the pig-iron after its uniformity has been checked by fracture, or by analysis if necessary. On the small scale, for special purposes, gas-furnaces are convenient for melting cast iron, but their use is limited, as the cost of gas is generally too high to allow of the application of gas on any considerable scale. Wind furnaces with fireclay crucibles and coke for fuel are in use in many cases where small castings are made, and where great uniformity is necessary a reverberatory or air furnace is employed. But in the vast majority of cases a small blast-furnace, called a cupola, is used, as it is cheap, rapid, and easily managed. The coke should be hard, and as free from sulphur and ash as possible. The amount of coke used will depend on the quantity of iron melted in a given time, and on the construction of the cupola. It may be reduced to as little as 1 cwt. of coke per ton of iron melted. Usually, however, from 2 to 3 cwt. is employed. In addition to the simple form of cupola so long in favour, a number of improved varieties have been introduced during the last few years. In Germany the Herbertz cupola has met with much favour, but has not succeeded in making its way in this country. It is worked with a steam exhaust instead of with a forced blast, as is usual. Where large quantities of metal of uniform quality are needed, a cupola with a receiver or mixer is to be preferred, and Stewart's "Rapid" answers very well. As the applications of cast iron are numerous, and, despite the competition of steel, appear to increase rather than diminish, the difference in form and variety of moulds is very great. The most general material used for moulding is green sand, a black mixture to be found in every foundry, and which gets its name from the fact that it is used in the raw or unbaked condition. For special purposes dry sand, loam, or cast-iron moulds are needed. Moulding machines are now being introduced into many branches of the trade where there is much repitition of simple forms, and it is stated that by this means the cost of moulding can, in some cases, be reduced to about one-sixth of what it formerly cost. The effect of re-melting cast-iron varies with the character of the metal, and with the method of melting. It has been frequently supposed that iron was improved by being melted and kept in the fluid condition, but Mr. Turner's analyses of the test-pieces prepared by Sir W. Fairbairn have shown that the effects obtained can be fully explained by the chemical changes that took place, and that the metal loses silicon and absorbs sulphur when it is remelted in the cupola or air-furnace. This makes the iron harder, and, if it were originally too soft, it improves it, while, if the metal were too hard at first, every melting only makes it worse. The properties of cast-iron are not altered when it is melted in a closed vessel so as to prevent chemical change. The various kinds of cupolas, moulds, &c., were illustrated by the aid of lantern views.

In the fifth lecture of the series Mr. Turner, in referring to the production of large castings, said that it sometimes happened that some special work was needed heavier than could be produced with the ordinary methods of working in the foundry ; at the same time it is out of the question to put down sufficient cupolas to meet such a case. To overcome the difficulty, it is the custom to melt a few tons of metal, or as much as the cupola will take, and collect the fluid metal in a covered ladle : another charge is then melted and added to the first, and the operation repeated as often as may be necessary, the metal in the ladle keeping quite fluid until it is required. With large castings special care is needed in weighting the top of the mould, or the liquid pressure will lift the top off and spoil the cast. It is also necessary to use a harder iron with large work, as the metal cools so slowly. Where special strength is needed care must be taken to have not only the right chemical composition, but also the size and shape of the casting suitable to the iron employed. Some iron is stronger in small castings than in large, while in exceptional instances the opposite is the case. In some forms of patterns, too, with abrupt changes of shape, planes of crystallization are developed, and there are causes of weakness. Where great crushing strength is required the iron should be hard and white, or nearly so. For transverse strength, a very close-grained grey iron gives the best result ; but where tensile strength is most wanted the iron should be soft and a good working metal, but still close and dense. When iron is too soft it runs easily and fills every line of the mould, but it is weak. The malleable cast-iron trade is a very important industry in the midlands, this variety of work being employed where a softness like that of wrought iron is required, but where the pattern is so complicated as to make a forging costly, and where only a moderate strength is needed. The metal used is a hard iron, usually white, which is specially free from silicon, manganese, and phosphorus. The castings are made in green sand in the ordinary way, except that in many cases a crucible is used for melting the iron. The castings so obtained are quite hard and brittle, and in their present state of no particular use ; but after they have been heated in closed boxes filled with hematite the character of the material is completely changed. The castings can be readily cut or filed, and the fracture presents a characteristic grey appearance ; the material has actually become so soft and malleable that it can be bent without fracture, like wrought iron. This remarkable change of properties is connected with the fact that during the so-called annealing, part of the carbon has been removed, and that which remains is converted into the graphite form. The large and extending use of malleable cast-iron bears testimony to its usefulness, though its introduction by unscrupulous persons instead of wrought iron has, doubtless, helped to give a bad name to some of the productions of the South Staffordshire district.

Separation of Iron, Cobalt, and Nickel.—From *Les Comptes Rendus de l'Academie des Sciences* we learn that G. A. LeRoy uses an electrylytic method for the separation of iron, manganese, nickel, and cobalt. To the solution in sulpuric acid a small quantity of citric acid and an excess of common sulphate and ammonia is added. With a current from two Bunsen cells the manganese deposits at the positive pole, iron, cobalt, and nickel at the other pole. The deposit of these three metals is rapidly washed and is then placed in a strongly ammoniacal solution of ammonium sulphate. With a weak and reversed current the metals dissolve. The nickel and cobalt re-deposit at the negative pole, and the iron remains in the solution as a precipitate of ferric hydrate, as citric acid is now absent.

On Natural Phosphates.*

By J. Lainson Wills, F.C.S.

When your President and Treasurer did me the honor to request me to read a paper on "Phosphates" before the Ottawa Field Naturalists' Club, I hesitated in complying.

"Phosphates" in a general way, as we employ the word in this locality, implies the crystallized Mineral Apatite so abundant in certain parts of our Laurentian formation. The good work done by the Geological Survey, has from time to time, through its officers, kept us well informed of the localities and peculiarities of occurence of the Canadian apatite, by valuable contributions from the pens of Sir Wm. Logan, Sterry Hunt, Vennor, Dr. Geo. Dawson, Torrance, Dr. Robt. Bell and others. At the present time, I understand that Mr. Ingalls also, who has been in charge of a special study of our Canadian apatite fields, is about to terminate and publish his preliminary report, so with deference to his opportunities and approaching publication, I could not presume to undertake a paper purely on Canadian phosphates or apatites as was proposed, but thought it might be acceptable to our members here to give their attention to a more extended and general consideration of natural mineral phosphates, and hence the title of my paper this evening, instead of being "Canadian Apatite" is "Natural Phosphates" in a more general way. My present occupations prevent me from giving much time and study to the preparation of this work, but if by some generalizations of facts we can awaken a healthy discussion and exchange of ideas, my humble attempt will not have been useless.

Natural phosphates owe their commercial value to the proportion of phosphoric element contained in them, and are employed as raw material for the manufacture of phosphatic fertilizers, being also sometimes applied in the natural and raw state direct to the soil by the farmer. They are also in demand for the manufacture of phosphorus, baking powders, and some other chemical products. By far the greatest demand for them, however, is made by the manufacturers for agricultural requirements, and this demand is yearly increasing at a very rapid rate. The occurence of natural phosphates presents the most varied and interesting modes of formation, as may be surmised by finding their deposits not only in nearly every geological system but in many different groups of the same system: Now in beds, which may be, have a fresh water or marine origin; now appearing as hardened conglomerate or rocks; and sometimes as sand and loose gravel: then again in vein formation or pockets, sometimes amorphous, at other times crystalised.

In the matter of texture, color and other physical characters, we find the same endless variation.

The origin of the demand for these phosphatized products is comparatively of recent date. It was only in the commencement of the present century that crushed bones were employed as a fertilizer in agriculture, and, strange to say, only then on account of the gelatine or organic matter they might contain!

The following curious statement, which appeared in a scientific journal in the year 1830, apropos of the employment of crushed bones in England, exposed the ignorance on the subject at that day, and read as follows: "As to the earthy matter or phosphate of lime contained in the bones, we may disregared it. It is insoluble and indestructible, and *cannot serve as a manure*, even in a damp soil, and in immediate contact with the rootlets of the plant."

The suggestion of Liebig, to treat the bones with sulphuric acid, opened a new era to the utilisation of phosphatic materials in agriculture, and the manufacture of artificial manure was soon established.

The illustrious Eli de Beaumont thus expressed himself with regard to the commencement of the mining of mineral phosphates. "Colbert has said that France would be lost for want of forests, and everyone perceives that without coal, his prediction would soon be accomplished.† In his day, one would have failed to comprehend how a great country might disappear."

Natural Phosphatic Deposits.

These valuable provisions of nature are the result of various causes and agencies familiar to the geological observer, and their contained phosphoric acid is mostly due to animal life; and when we say "due" to animal life we wish to imply that animal life is the assimilating and concentrative medium of *pre-existing* phosphoric acid. Whether as sea and fresh water shells, as fish and animal bones, as excreta of birds and saurians, etc., animal organisms have been from the beginning of life, and still are, the silent but mighty laboratory of nature, never resting to collect and store up the dispersed molecules of phosphoric acid. Among such are the guano beds of recent epochs, coprolitic deposits, bone beds, shell beds, etc.

Nature's operations of bringing these materials or their debris together to form whole geological areas are equally varied, but the esturaries and depressions of the sea bottoms of the different and respective geological periods are recognized to have been the receptacles or store houses of these wonderful supplies. A curious disposition to concretionary action, displayed by nuclei of certain organisms to absorb and accumulate phosphatic matter, with which the ancient seas abounded, is more easily seen in its effects than explained.

* Paper read before the Ottawa Field Naturalists' Club.

† Jean Baptiste Colbert, born 1619, Minister of Finance to Louis XIV.

Such is the origin of many odd species of nodules, some varities of which exist in immense quantities.

The abrupt or imperceptible, but never ceasing operations of geological rearrangement, follow the aforementioned accumulations, and we then have new forms of mineralized phosphatic matter, giving rise to conglomerates, breccias, phosphatic limestone, shells and marls, sandy and ablation desposits, etc., and most of the known natural deposits of mineralized phosphate display examples of two or more of these products. For instance, the perplexities experienced just now with some of the exploratory workings of the lately discovered Florida deposits, are chiefly occasioned by the character of these beds containing boulders, and nodules from pea size to masses of several hundred pounds in weight, fish bones, shark teeth and fossil bones, in fact *debris* from several geological epochs, each of these materials naturally varying in their purity, and therefore their commercial value, so that the more successful enterprises may be looked for where regular and homogeneous deposits occur, or some cheap and efficient mechanical means are applied for the separation of the marketable products from the less valuable or worthless intermixtures.

The classification of natural phophates of lime is, as remarked by Dr. Penrose in Bulletin No. 46 of the U.S. Geological Survey, "a matter attended with many difficulties, not only on account of the great variety of forms in which phosphate of lime occurs, but also because many varieties blend into one another, thus often rendering it uncertain to which class a special deposit should be referred;" and he adopts the following classification, based mainly on the chemical composition of the deposits, and grouped under the headings thus:—

- Mineral Phosphates..
  - *Apatites.*
  - *Phosphorites.*
    - *Fluor-Apatites.*
    - *Chlor-Apatites.*
- Rock Phosphates ....
  - *Amorphous Nodules.*
    - *Loose Nodules cemented (conglomerates).*
  - *Phosphoric Limestone Beds.*
  - *Guanos.....*
    - *Soluble Guanos.*
    - *Leached Guanos.*
  - *Bone Beds.*

We shall recognize, as we proceed with the study of the various phosphatic deposits formed during the different geologic periods, that by far the greater part owe their origin to animal or organic remains, and we shall see that as soon as the organic compounds of a guano, for example, are dissipated and resolved into their elements, we may consider that the residual products, to all intents and purposes, revert to the mineral state, in accordance with the familiar expression "earth to earth."

We pass over, for the present, the guano of various localities, which however, will be observed to lie mostly within 10 to 20 degrees of the Equator.

We should remember, however, that this product has probably obtained its zenith, both as to quality and quantity, and must cede its commercial importance ultimately to the mineral resources of phosphoric acid, which are before us for our more particular consideration.

We shall find the diagram on the wall, which shows the approximate geological position or age of the different phosphate deposits, very useful to our present purpose, and we will commence with the more recently formed or mineralized products:—

Occurrence of Natural Phosphates in the Geological Epochs.

Post-Tertiary or Quarternary System:

True guanos.
Crushed or "leached" guanos.
West Indian and Pacific phosphates.

Tertiary System:

West Indian Rock Phosphates.
Nassau or Lahn nodular concretions.
Suffolk Coprolites in the Red crag and Coralline crag; (reposing on Lower Eocene).
South Carolina beds, resting upon Eocene.
Deposition of Florida phosphate, *debris* and organic remains.
North Carolina, overlying Eocene marl.
Fundamental rock of Florida phosphate deposits.
Clays and *debris* of Bordeaux phosphates.

Cretaceous System:

Belgian (Liege) Hesbaye nodules.
American Alabama amorphous nodules.
New Jersey marls.
Belgian (Mons) Ciply nodules (Mæstricht beds).
Somme deposits, arenaceous and nodules.
Russian "Samorod" nodules Desna-Don.
Cambridgeshire and Bedfordshire Coprolites.
French nodules of Ardennes, Meuse.
French nodules of Montpellier and Bellegrade.

Oolitic or Jurassic System:

Bordeaux Phosphorites and nodules overlain by Tertiary (Eocene) clays and *debris*.
Algerian Phosphates.

Triassic System:

Highly phosphatic beds, (between Trias and below Lias), containing exuviæ of huge reptiles as well as remains of fish and crustaceans.

Permian System:

(Appearance of Reptilia.)

Carboniferous System:

(Appearance of Amphibia.)

Devonian or Old Red Sandstone:

Highly phosphatic beds in junction with Lower Carboniferous.
Highly phosphatized bed in Shropshire, containing oldest known remains of vertebrate life associated with crustaceans.

Silurian System:

(Appearance of Vertebrata.)
Welsh Bala beds; Berwyn Phosphate mine.
Lingula flags (Quebec), 40% Tribasic.
Angers slates (France).
Phosphate limestone of Kentucky.
Logrosan (Spain) Phosphorites. (Apatites?)
Caceres (Spain) Phosphorites.
Portugal Phosphorites.

Cambrian System:

(Appearance of Protozoa, Mollusca, Annuloida and Crustacea.)

Laurentian System:

Canadian Apatite.
Norwegian Apatite.

Thus at the present time, we have mineral phosphates of lime in process of formation, and principally known in commerce as "Grust Guano."

Looking at the chemical composition of average bird guano, we find it to be composed of the following constituents:—

Moisture	15.8
Organic matter and Ammoniacal Salts	52.5
Phosphates of Lime	19.5
Phosphates of Iron and Alumina	3.1
Alkaline Salts	7.6
Silica and Sand	1.5
	100.0

This typical analysis is from the average of 15 samples, made by Nesbit on the Chinchas inland guano.

An elementary knowledge of chemistry will assist us to perceive what a large proportion of the above constituents will be leached out by water, or dissipated by prolonged exposure to ordinary atmospheric influences, especially when we remember that the organic matter above mentioned comprises uric, oxalic and phosphoric salts of alkalis and ammonia, and even about one-third of the phosphate of lime is found to be soluble in water. Given a deposit of guano on a limestone soil or rock, and it is readily perceived that every shower will contribute to the steady but continual process of the transmutation of the carbonate of lime into phosphate of lime in consequence of the discharge of the weaker carbonic acid by the stronger phosphoric acid.

The exhausted guano then becomes phosphatic in distinction to being nitrogenous and ammoniacal ("leached"), and the subjacent limestone undergoes a metamorphosis, by a double decomposition, into phosphate of lime. If the absorbing limestone is pure, the phosphate of lime thereby formed will be correspondingly pure; and on the other hand, if the calcareous base is intermixed with clay or sand, or ferruginous material, the newly formed product will contain alumina, silica, oxide of iron, etc., in like proportions.

Such has been the undoubted origin of the deposits of Aruba rock phosphates, samples of which are on the table, and which are typical of this kind of metamorphosis, and will serve to illustrate many similarly formed deposits, notably those of Curacao, Sombrera, Navassa and Redondo, (in which latter case the subsoil must have been aluminous, since the mineral is a phosphate of alumina).

In some cases, the phosphatic principle may have been derived from animal *debris*, such as bones.

The composition of animal bones varies somewhat, according to the animal furnishing them, and even with the particular part of the same animal, but the following analysis, expressed in 100 parts, may be taken as an average:—

	Green Bones.	Bone Ash.
Moisture		
Organic matter	33 (gelatine)	
Phosphate of Lime	56	70/75%
Phosphate of Magnesia	3	
Carbonate of Calcium	3	
Alkaline Salts	4	
Silica	—	

The bones of birds are even richer in phosphoric acid than those of mammals, but bones of the *Amphibia* and fish contain less than those of birds and mammals.

Amongst other animal organisms rich in phosphoric acid or phosphate of lime, may be mentioned certain shell fish, or rather their shell remains, notably the shells of *Lingula* and *Orbicula*, which consist for the greater part of phosphate of lime, and are found in accumulated beds in the Lower Silurian rocks, being thus described by Sir Wm. Logan (Geology of Canada, 1863). Those coming from the Chazy formation at Alumette Island left after calcination, 61% of fixed residue, consisting of:—

Phosphate of Lime	85.7
Carbonate of Lime	11.7
Magnesia	2.6
	100.0

And analysis of the original material gave as follows :—

	Alumette.	Hawkesbury.	River Ouelle.
Phosphate of Lime....	36.38	44.70	40.34
Carbonate of Lime,some			
Fluorine.....	5.00	6.60	5.14
Carbonate of Magnesia.		4.76	9.70
Oxide of Iron and			
Alumina.....	7.02	8.60	12.62
Magnesia	....	....	....
Insoluble.....	49.90	27.90	25.44
Volatile by heat.....	1.70	5.00	2.13
	100.00	97.56	95.37

We here observe an average of 40% of phosphate of lime. It would appear that our knowledge of the proportion of phosphatic element in similar animal remains is very imperfect, so that upon further investigations we may expect to meet with many other similar accumulated supplies of phosphoric acid.

Some authorities attribute a large portion of the phosphate of lime in the Charleston fields to such mollusks and principally *Lingula*, *pyramidata*, which are found abundantly on the present coast.

Classification of Natural Phosphates.

I prefer for all practical purposos, and from rational observation, to modify the classification proposed by Dr. Penrose, thus :—

APATITES.....	*Fluor-Apatites.* *Chlor-Apatites.*
MINERAL AND ROCK PHOSPHATES.....	*Phosphorites.* *Nodules, Coprolites.* *Concretions.* *Conglomerates.* *Phosphatic Limestone.* *Phosphatic Marls.* *Crust Guanos.*
GUANOS.	*Nitrogenous.* *Phosphatic, or "leached."* *Bat Guano.*
ANIMAL REMAINS.....	*Bone Beds.* *Shell Beds.* *Animal exuviæ.*

We will now proceed to trace in a cursory way the commercially known deposits, commencing with the most recent and passing stratagraphically in descending order to the more ancient formations.

Classification of Natural Phosphates.

Guanos.

Guanos are of two kinds : Nitrogenous, or those containing their original manurial qualities, and phosphatic or "leached," the latter being in a more or less mineralized condition by exposure to weathering.

Among the nitrogenous guanos we have the Peruvian, Ichaboe, Patagonian and Falkland Islands.

The phosphatic or weathered guanos include those of the Pacific or Polynesian Islands, Sidney, Phœnix, Starbruck, Baker, Howland, Jarvis, Enderbury, Malden, Lacepede and Arbrohlos Islands.

Some of these deposits are more or less exhausted, and new islands furnishing similar products are from time to time worked.

The West Indian guanos are from Aves, Mona, Tortola.

Other South American are Patos Islands, Megillones, Rata.

From Africa, Saldanta Bay and Kuria Muria Islands.

Bat guano, the products from the floors of caverns inhabited by bats, have sometimes been sent to market as a rich fertilizer. It is found notably in Cuba (W.I.) and in North Borneo. It possesses a characteristic dark brown color and exhibiting the undigested parts of beetles' wings and insect *debris*.

Bone Beds.

These are found in nearly all sedimentary strata, from the Devonian up to the present time, but with the appearance of those remarkable *Reptilia* in the Permian age, we find that these kind of phosphatic provisions of nature took enormous developments, augmenting the resources previously furnished by the *Amphibia* of the Carboniferous epoch.

Bone beds however in their original state, have furnished little to commercial supplies of phosphatic products, excepting those found in the Tertiary and Quarternary ages, such as Bordeaux, Carolina, Florida and Sombrero (breccia).

Shell Beds.

Since these must have existed from a time well into the Palæozoic periods, or that is to say, from the Cambrian age, we may expect and do find these mollusca remains through a wide range of systems and strata and up to recent times.

The Silurian Lingula beds are remarkable, and have been already particularized as a probable abundant source of phosphoric acid.

The Welsh Silurian beds, and the French Bellegrade and Ardennes deposits in the lower Greensand (Cretaceous), exhibit evidence of this origin, while the Tertiary and Quarternary phosphates contain very frequently these marine and fluvatile remains as a contribution to their value in phosphate of lime.

Some very interesting specimens are on the table from the Dutch West Indies, containing from 75 to 80% of tribasic phosphate of lime, and exhibiting in some cases one mass of shells belonging to recent times.

Coprolites

Owe their name to Professor Henslow, and should be applied only to the fossil *exuviæ* of animals. The appellation has extended itself to many rolled or gravelly products, chiefly found in the Cretaceous formation. In England they have been worked to a large extent in Bedfordshire and Cambridgeshire, where they appear in the (Neocomian) strata, between the chalk and the subjacent Jurassic system, in nodules and pebbles of size from a pea to a hen's egg, and sometimes cemented by ferruginous sand into a hard conglomerate ; organic remains are present, and casts and fragments of fossils with abundance of *Ammonites*, vegetable remains and other *debris* of the Jurassic epoch (Iguanodon and Megalosaurus, etc.)

The commercial products contain from 45 to 55% phosphate of lime.

The Coprolites of Suffolk occur in the Tertiary, being in the older Pliocene (the Red crag and Coralline crag). They are poorer in phosphate of lime, more ferruginous and harder in texture.

France also possesses some deposits of this character at Bellegrade, near the Swiss frontier, and also at Montpelier and Avignon, yielding 54% tribasic of lime.

Nodular, Concretionary and Arenaceous Phosphates.

These, by far the most important of nature's phosphatic reserves, comprising as they do the South Carolina deposits, the French deposits of the Somme, Ardennes and Meuse, the Belgian fields of Mons and those more lately opened up at Liege (Hesbaye). The so called "Bordeaux Phosphates," because being formerly shipped from that port, but having their real origin in the region of Quercy, comprising portions of the departments of the Lot, Tarn and Garonne and Aveyron, also furnish a considerable quantity of nodular or phosphatic concrétions of kidney shape of great purity (88%) and curious geological interest. These are well represented by specimens on the table, and coming from the crevices in the Oolitic limestones, accompanied by *debris* of Tertiary age (Eocene), the walls of the crevices or fissures being at the same time incrusted with phosphorite of a high degree of purity, attaining 80% of tribasic phosphate of lime.

We must not omit here the Florida nodular beds of land and river formation, which are now enjoying such a glorious boom.

As a peculiarity of this Bordeaux phosphorite, we may mention that it contains a very appreciable proportion of iodine.

The Russian deposits, situated between the rivers Desna and Don, occur in the Cretaceous system, at about the same horizon as the Cambridgeshire coprolites and may be described as nodular.

The Nassau or Lahn concretions in clay are of Tertiary age, and although not exhibiting signs of organic remains are generally believed to be of animal origin ; they attain 60 to 75% phosphate of lime, but are too ferruginous to be much in request for superphosphate manufacture.

The Belgian (Ciply) deposits, which have furnished over 150,000 tons per annum of a 40 to 50% product, is of a nodular character, although the grains are often so fine as to be considered more correctly arenaceous.

The same may be said of the very remarkable French deposits, discovered near Amiens in 1886, and known as the Somme phosphates. These are granular or arenaceous, and to this feature as well as to their richness (65/80%) may be attributed the enormous development which they have enjoyed in such a short period, attaining the annual production of 200,000 tons.

Conglomerates and Breccias.

Phosphatic beds may also assume these characters, sometimes with the cementing material as the phosphatic element, and at others with the enclosed pebbles or angular fragments as the valuable portion for commercial supplies.

Thus the Cambridgeshire coprolite fields furnish a conglomerate of phosphatic pebbles, cemented by ferruginous sand, while at the Ardennes district (France) is found a peculiar agglomeration of granules of chlorite in a phosphatic cement, the whole yielding 40 to 45% phosphate of lime.

The Belgian (Ciply) deposits yield abundant supplies of a mass of phosphatic nodules, shells, casts and fossils, cemented in a calcareous matrix, to utilize which has puzzled the mechanical ingenuity of many an "*exploitant.*"

Phosphatic Limestone and Marls.

These are found in most strata from the Silurian epoch down to more recent times.

The metamorphosis or transmutation of earthy carbonates into phosphates is a very simple and comparatively rapid process, and the evidence of Dr. R. Ledoux in the following description is instructive. He says in a recent article on phosphates: "Some clients of mine sent a ship to a coral island in the Southern Pacific to bring away a cargo of bird guano. The birds were still in countless thousands. The captain had been there for a load 20 years before, and since that time no guano had been removed. At his first visit the crew had cleaned off a space and made a house of coral rock, covering it with a sail and had used it for a shelter and store-house while at work. On leaving, the sail was taken away and the walls and board floor left. On the return, 20 years after, there was an average depth of 20 inches over the floor—an inch a year. The underlying limestone was altered into phosphate for a depth of several feet, but the conversion of carbonate into phosphate gradually became less perfect as depth from surface was attained."

I have observed the same effect myself taking place in the West Indies, where the surface of the coral rock is speedily converted into phosphate of lime, wherever the sea birds are in the habit of congregating.

Such indeed is the simple origin of some of the most important deposits of phosphate in that part of the world : i.e., Curacao, Sombrero and Aruba, etc.

The prospecting and first development of the latter named island having fallen to my own care and experience, I am able to produce some interesting specimens here, illustrating very clearly the history of their formation by examination of their fossil organisms, originally carbonate of lime (coral rock), and now seen to be, by analysis, phosphate of lime of over 80%.

The deposits of Florida and South Carolina would appear to owe much of their phosphatic wealth to *debris* of phosphatized limestones and marls.

One of nature's operations, which is a factor in enriching already formed phosphate beds, may be here alluded to, namely the property of spring waters (which often contain considerable proportions of bicarbonates and free carbonic acid gas) to dissolve neutral carbonate of line, even when presented to them in apparently the most compact and impervious material. Such has been the origin of the many remarkable caves existing in the limestone rock formations (Cheddar, Derby, Kentucky, etc.)

This property, applied to a calcareous phosphated material, will in course of time, ablate as it were, more carbonate than phosphate, and to this action is attributed the value of many thousand tons of material in such extensive beds as those of the Somme, Ciply, Liege and probably af Florida.

While speaking of these beds of the Cretaceous period, I may mention the recent opening up of another similar field in France. I refer to that in the department of the Pas de Calais, which would appear to be of the same nature as that of the Somme.

Apatites

Although crystallized phosphate of lime is found as a component of rock masses in more recent strata, yet we do not yet know of any workable deposits of this mineral before passing to the oldest of fossiliferous systems, the Laurentian.

The rocks of this formation are among the most ancient on the North American Continent and probably correspond to the oldest gneiss of Scandinavia. The modes of occurrence are so varied in the Canadian Apatite field, that the subject would require to be treated by itself in order to do it justice here.

We are all here familiar with how it is found both in Ontario and Quebec provinces.

Dr. Hunt thus describes in 1884 the main features of its mode of occurrence : "The deposits of Apatite are in part bedded or interstratified in the pyroxenic rock of the region, and in part are true veins of posterior origin. The gneissic rock, with their interstratified quartoze and pyroxenic layers, and an included band of crystalline limestone, have a general northwest and southwest strike, and are much folded, exhibiting pretty symmetrical anticlinals and synclinals, in which the strata are seen to dip at various angles, sometimes as low as 25 degrees or 30 degrees, but more often approaching the vertical. The bedded deposits of apatite, which are found running and dipping with these, I am disposed to look upon as true beds, deposited at the same time with the enclosing rocks. The veins, on the contrary, cut across all these strata, and, in some noticeable instances, include broken angular masses of the enclosing rocks. They are for the most part nearly at right angles to the strike of the strata, and generally vertical, though to both of these conditions there are exceptions. One vein, which had yielded many hundred tons of apatite, I found to intersect, in a nearly horizontal attitude, veitical strata of gneiss, and in rare cases what appear, from their structure and composition, to be veins, are found coinciding in dip and in strike with the enclosing strata."

The apatites of Norway are known since 1854, and occur on the southern coast in similar rocks to our own, (Canadian) and many of the associated minerals are similar to those observed in the Laurentian rocks, the vein matter differing chiefly in freedom from carbonate of lime.

Rutile may be mentioned as an exception, which in some mines is so abundant as to form a considerable revenue to a working mine, since it is worth about 1/6d. per lb., say $800 per ton. These are fluor-apatites, although they contain also some chlorine.

Continental geologists, (Brogger and Rensch) who have studied these formations, have supposed them to be of eruptive origin, in consequence of the absence of phosphoric acid in the surrounding rocks, but the question seems to be most doubtful, as well here as in the case of the same opinion held on the Canadian apatite deposits.

The Situation of Canadian Phosphate Trade.

Although this Canadian industry has not progressed on the same scale as many other phosphate fields, Somme, Ciply, Liege, Carolina and Florida, yet there are some facts offering an explanation for this. The peculiarity of the occurrence of the mineral, in vein-like formation in hard rock, calls for a scientific and economic system of mining, which has been little applied to the development of our deposits, and the cost of production is thereby more considerable than that attained in other fields of supply.

Certain centres of manufacture still require our high-testing products to complete their standard types of

concentrated *supers*, and the rapidly increasing demand for fertilizers by all the civilized world, both the new and the old, will tend to maintain a fair value for natural phosphates. We are getting into the era in which steam does not work fast enough, and on every hand we are seeking to accomplish our ends by electricity with lightning speed. Some one has said that the man who could make two blades of grass grow where one only grew before, was a benefactor to his race, but the rush and struggle for existence imposes that every cultivator shall be a benfactor in this regard, and carry on agricultural science at the highest possible tension for his very existence.

With increasing populations, with better means of transport, and lastly, but not least, advanced scientific education, fertilizers and all other artificial means of stimulating our exhausted soils will continue to be in increasing demand.

We see no reason therefore to suppose that the mineral phosphate industry or phosphate mining has attained its zenith, and so far as we can see at present, the future demands of the world for phosphoric acid are destined to increase with time and agricultural progress.

Resume.

We may now shortly generalize the foregoing facts and observations.

Of the sixty-four elementary substances at present known to compose the material of our original globe, phosphorus is found to be among the twenty more abundant elements, and is recognized to have been widely disseminated in all the original and ancient rock masses. With the exception of the segregations of crystallised apatite in the Laurentian rocks, we do not find any marked local accumulation of phosphatic bases in any of the azoic formations, or intrusive rocks.

The existence of the Eozoon Canadense is still debatable, and it is problematical whether the apatite of these older metamorphosed strata is not the mineralised product of organic remains, but passing from the Laurentian epoch to the succeeding and less altered rocks, we are immediately in presence of abundant evidence of organised life, and cannot fail to remark how much more frequent are the accumulations of phosphatised beds.

The function of organised life to assimulate and concentrate the disseminated phosphoric element is strikingly apparent. The natural forces which are ever restless and continual in building up the varied geological strata of succeeding epochs (attrition, deposition, cementation, ablation etc.) may alter and vary the manner of presentation of the phosphatic deposits which we have been considering, but the silently working power of assimilation by the organised cell would appear to triumph over the mighty disruptive and more violent operations of nature, for the latter forces fail to redisseminate the work accomplished by the former, but rather complete the task required to secure to man the providential supplies of phosphatic deposits with which we may satisfy our present demands, and therefore these economic supplies are seen to be chiefly in the more recent geological formations.

"A New Use For Old Ropes."*

By Robert M'Laren.

It has long been a source of anxiety with mining managers what to do with winding ropes which have been thrown off, as they can be used for few purposes about a colliery; and the price received when disposed of is so small that, rather than sell them, they allow them to lie about as so much useless material, probably with the hope that a use will be found for them some future day.

Owing to the difficulty in disposing of some old iron winding ropes, taken from No. 1 Pit, Gilmerton, at a remunerative price, the manager, Mr. Hutchison Burt, determined to utilize them on an incline, or "cran brae," in place of iron rails and wooden guides in use on the other inclines.

The colliery is situated to the south-east of Edinburgh, and is owned by the Gilmerton Gas Coal Co., Ltd.

The shaft (No. 1) is sunk to the Stairhead coal, at a depth of 88 fathoms.

From the shaft crosscut mines are driven east and west. On the west side the following seams are intersected in their order: Gillespie coal, Blackchapel coal, Coalpatty coal, Stinky coal, Glass coal, North Parrot coal, Corbiecraig coal, Peacocktail coal. The mine to the east side cuts through the Great coal seam. Six of these seams are presently being worked. The measurcs are in the carboniferous limestone series, and are highly inclined, the inclination varying from 65 deg. to 78 deg. The coal from the various seams is lowered to levels by inclines in cages or carriages. There are five inclines in operation—three with wooden guides and cages, one with iron rails and carriages, and one (Corbiecraig) with wire ropes and carriages.

Corbiecraig incline is 96 yards long, with eight stopping places, 11 yards apart, worked by a drum at the top, 6 ft. diameter, with brake attached, and steel haulage ropc ⅝ in. diameter. The signalling is the usual method adopted in the steep measures. The inclination is 72 deg., except 30 yards or so at the top, which is 65 deg. On this incline the Corbiecraig coal and the North Parrot coal, about 8 yards back, are lowered. The latter is reached by back mining.

The Corbiecraig coal is worked stoop and room, stoops 20 yds. on level by 8 yds. to rise, with openings 9 ft. wide; and the North Parrot coal is worked longwall.

Roadway.—The road is 12 feet wide by 4 ft. 6 in. high (average), and has a carriage and back balance way. Sleepers, 9 ft. by 8 in. by 3 in., are laid across every 4 ft., and on these are fixed planks 6 in. broad by 2 in. thick, laid longitudinally. Again, on the longitudinal planks the ropes, 3 in. circumference, are laid, and to make them rigid the following method is adopted:—At the foot of the incline a beam, 9 in. square, is fixed. Into this a hole is bored, and the rope is passed through, and is glanded on the under side of the beam. At the top the rope is fixed to a screw by means of a hose and muzzle, and as the screw is turned the rope tightens. As soon as the rope is stretched spikes or large nails are driven through its centre to fix it to the plank. The spikes are 8ft. apart.

The gauge for the carriage way is 4 ft. 6 in., and for the back balance way 1 ft. 10 in.

Carriage.—The carriage is 10 ft. long by 4 ft. 3 in. broad by 3 ft. high, is of angle steel, 2 in. by ¼ in., and carries one tub. The wheels are made with a groove 1 in. deep to fit into the rope, and are 5 ft. apart.

The speed of the carriage is twenty seconds for the journey from top to bottom, equal to 9·75 miles per hour; but the average is about half that speed. The weight of the carriage when loaded is 13 cwts.

Back Balance.—The back balance consists of a plank fixed to two axles, on which are wheels, same as on the carriage, and loaded up to the required weight. This back balance is insufficient for the part of the roadway which has the reduced gradient, and in consequence a second back balance is in use, which rests on a block, and is raised by the main back balance when ascending, and stops at the block when descending.

The second back balance is similar to the main back balance, except that is fixed a projecting piece of wood each side, 6 in. square, which come against the block, and the back balance is brought to rest. The block consists of two planks, 9 in. by 3 in, placed upright and firmly fixed between roof and floor.

To prevent the back balance when at rest from going over the block and tumbling down the incline, there is fixed a small pulley over which the haulage rope passes. The pressure of the rope on the pulley is sufficient to keep the back balance in its place, but, in case the rope should rise, two glands, raised in the centre are fixed close to the pulley, and the rope runs through them.

The incline has been in operation about six months, and has worked very satisfactorily, havinggiven no trouble, neither carriage nor back balance having once left the ropes.

The advantages claimed for this rope road are:—(1) It is much cheaper, as the ropes are of little value; (2nd) It is easier fitted up, and, when compared with a similar incline fitted with iron rails, the cost is about one-sixth.

Discussion.

The PRESIDENT remarked that this was a paper describing another source of economy in coal mining, which seemed to work satisfactorily.

Mr. FAULDS asked if Mr. M'Laren would tell them if the ropes he described had many broken wires projecting out, or were they just slightly worn?

Mr. M'LAREN said he had not travelled the incline, but the manager, Mr. Burt, was there, and could doubtless answer the question.

Mr. BURT said he did not think the ropes contained any broken wires. They were ropes that had been at the colliery for four years.

Mr. MENZIES, former manager, said he was under the impression that the ropes had not worked for six months. They were good ropes, but got cut on a pulley and were put aside, and he had no doubt these were the same ropes.

Mr. M'LAREN.—In that case they were useless for winding, and therefore old ropes.

Mr. MENZIES.—Most certainly.

Mr. FAULDS said he would like to know how long the ropes had been in use, and whether the wheel was malleable iron, cast iron, or steel, grooved or otherwise.

Mr. M'LAREN said the wheels were grooved wheels, and similar to the ordinary winding pulley.

Mr. GEORGE THOMSON said, as one who had had some experience of steep workings, he thought Mr. Burt had great credit for the idea he had brought out. Especially where the inclination varied, he knew that it was scarcely possible to keep ordinary rails in their position unless they used a heavy rail, which was very expensive. Mr. Burt's idea was a new one, and he thought, a correct one, even though new ropes should require to be applied. He thought that a spike every 4 feet would be better than one every 8 feet. However, they would find that out by experience.

Mr. FAULDS said with grooved pulleys he did not suppose it would matter whether it was 4 or 8 feet.

Mr. HUGH JOHNSTONE said he thought it was a good idea to have practically continuous rails. This arrangement got over a difficulty which he had experienced when at Niddrie. He had no doubt if their wire rope friends took up the matter they would get over the difficulty of the broken wires by substituting a rope for the purpose.

The PRESIDENT said the use of old wire ropes in this way would depend on whether the price they got for them was more or less than the price of rails.

Mr. M'LAREN said the price of old wire rope was 20s. per ton.

The PRESIDENT proposed a hearty vote of thanks to Mr. M'Laren for his paper, which was agreed to.

The Speakman Water Cartridge.

In a paper read before a recent meeting of the Federated Institute of Colliery Managers, Mr. J. J. Speakman said:—

There was no direction in which improvements had been greater or attention more fixed than in that of explosives. After carefully examining the results of the many tests that had been made, it seemed not too much to say that amongst them the water cartridge, as used with gunpowder, might be fairly classed amongst the safest types. The comparative ease and safety with which colliers could handle gunpowder (which for so long a time was almost the only explosive), its freedom from gases injurious to health, the completeness with which the water extinguished the flame when the cartridge was properly made and placed in the hole, and, above all, the generally correct estimate a collier could form of the quantity required in a shot so as to yield the largest quantity of round coal, seemed to point to gunpowder being reinstated in the estimation of mining engineers and becoming again almost the sole explosive used in mines. Many and various experiments had been made for the prevention of flame as produced from ordinary charges for bringing down coal to that of the blown-out shot, and to avoid its coming into contact with fire-damp and coal dust. The greatest advance towards safety in coal mining was due to the discovery made by Sir Frederick Abel of using explosives enclosed in a water shield, now known more particularly as the water cartridge. The lecturer was inclined to give Mr. Tonge, who read a paper on the subject before the Manchester Geological Society in 1880, the credit of the invention and use of tin cartridges, and although at first they were not successful, they were used successfully afterwards. Captain M'Nab took out his patent in 1876 for the paper-bag cartridge, which, when used in a proper manner did good work, but did not supply the long-felt want. Mr. Miles Settle designed a tin cartridge, but it was rather cumbersome, and the difficulty of manipulating it militated against general adoption. Mr. Speakman now submitted a tin cartridge, which, he said, answered every purpose, and was probably the best water cartridge which had yet been before the notice of the public. It was simply worked, and thus enabled every miner to be in the position at any time to use it himself, without the assistance of the shot-firer. A series of tests were recently made at the Bedford Leigh Collieries, near Manchester, in the presence of a number of mining engineers connected with the neighbouring pits, as well as Mr. Saint, Her Majesty's inspector of mines. In these tests the explosive charge used in the cartridge was tonite, and four shots of four ounces each were fired in coal. The experiments were satisfactory, as there was an entire absence of flame, and the coal was brought down in excellent condition. The charge of explosive when in the cartridge lay in such a position as to be almost completely surrounded by water, and by thus placing the charge in the bottom of the cartridge it was claimed that there was a greater head of water for extinguishing any flame that might arise when the charge exploded.

In the discussion which followed, several gentlemen pointed out that it had been proved that under no circumstances could the flame from gunpowder be prevented by water.

Foreign Coal Used at the Government Cartridge Factory, Quebec.

(*Proceedings House of Commons.*)

Mr. McMULLEN—I see that 290 tons of coal are charged for the cartridge factory at $6 a ton, with so much for duty. Is this American coal?

Mr. BOWELL.—I do not know. All the coal was purchased by tender. I do not know whether it is American or Scotch coal.

Mr. McMULLEN.—Is it American coal or Scotch coal? There is $196 duty paid, and we would like to know whether it is coal from Nova Scotia or coal from the United States?

Mr. BOWELL.—Does not the hon. gentleman think that question a little captious? If it were Canadian or Nova Scotia coal, certainly the duty would not be there. It must be either English or American coal.

Mr. FORBES.—Where is this coal delivered?

Mr. BOWELL.—In Quebec for the cartridge factory.

Mr. FORBES.—Then it is not Nova Scotia coal?

Mr. BOWELL.—Certainly not.

Mr. FORBES.—Why is it that the department does not use Nova Scotia coal?

Mr. BOWELL.—Since I have been at the head of that department I have always instructed the deputy to accept the lowest tender.

Mr. FORBES.—Then I am to presume that American coal, with the duty, costs less than Nova Scotia coal?

Mr. BOWELL.—You may presume what you like.

The Quebec Asbestos Mines Re-open.—Advices from the Eastern Townships report that the asbestos mines at Thetford and Black Lake, which have been closed since November last, resumed working during the month.

*Transactions Mining Institute of Scotland.

MINING NOTES.

[From Our Own Correspondents.]

Nova Scotia.

Killag.

Mr. D. S. Turnbull, formerly of Renfrew, has resigned his connection there and has accepted the management of the Old Provincial Co. at Killag. Mr. Turnbull will have entire charge of both mines and mills.

Salmon River.

Mr. Lucius J. Boyd has been engaged by the Dufferin Co. the past month in making an extensive series of surveys and maps of the surface and underground works of the company. The reports from the mine are unchanged.

Mount Uniacke.

The McCallums, representing the Alpha Company, have made arrangements with Prince et al., owning the ground immediately north, into which the rich lode is dipping, and work on the extension has been begun.

Messrs. Madill and Archibald are prosecuting their search for the big roll, but have not yet reported success.

South Uniacke.

The Thompson-Quirk people are going on in the even tenor of their way. The pay chute has over 160 feet yet to run before reaching the boundary line.

Montague.

The English syndicate have not yet bought the Annand mine, though it is rumoured that a further extension of time has been given. Meanwhile Manager McQuaine has begun to sink again, and will soon have plenty of stoping ground available.

Molega.

It is rumoured that the Molega Co. are entertaining a proposition for a sale. Mr. John McGuire, formerly manager of the company, has been in Molega again, and is said to be engineering the sale.

Oldham.

The Rhode Island Co. have abandoned their western workings and have gone close to their eastern boundary, where they are sinking a vertical shaft to strike the Dunbrack lode. The shaft will be about 75 feet deep before it cuts the lode.

Messrs. Isner and Vandegrift have found a cross lode showing coarse gold some two miles westerly from Oldham District. No regular lodes have been found of any value. There is some local excitement, but it is yet too early to say anything favourable of the new find.

Waverley.

The West Waverley Co. have been running their mill steadily, one shift, during April. The double shift went on on the 18th inst., and the management hope to keep double shift as a permanent thing. The mill is not yet completed, a concentrating plant being in course of erection.

The Lake View Co. have advertised for twenty-five miners, and it is rumoured that more extensive workings will soon be commenced.

Pictou County.

With reference to the progress of the works of the New Glasgow Iron, Coal and Railway Co. at Ferrona, our correspondent writes :

The railway is completed and in operation from Eureka Junction on the Intercolonial Railway to the Black Rock Mine, a distance of 10½ miles. Besides this, about two miles of sidings are laid. Freight for all parties is being carried over the line, but passengers are not yet taken.

The furnace and accompanying plant at Ferrona are nearing completion. The stock house, iron cast house, engine house, boiler shed, buildings for coal washing and storing are all completed. The blowing engines, built by the Philadelphia Engineering Co., are on the ground and in course of erection.

The coke plant consists of a coal washing and separating plant and improved Belgian coke ovens, both of which are new to this country. The boilers, which are also all in place, will be fired by the waste gases from the coke ovens. The coke will be discharged from the ovens by a steam engine and pusher at a very trifling expense compared with the usual style of discharge from the bee-hive oven. The company expect to manufacture coke in the course of a few weeks, and to commence the production of pig iron shortly after.

At the mines, the slope at Bridgeville has been unwatered and for the past month or two has been producing about 50 tons of ore per day. This will be increased as soon as the furnace goes in full blast. At this mine there are over 5,000 tons of ore on the dump. The Black Rock Mine has been working steadily since its discovery two years ago, and during the winter has produced 50 tons per day in development work. There is a fine face of ore, nearly 50 feet in height, to quarry from by open cut as soon as the furnace goes in blast, and also a very large ore dump.

Two new shafts are being sunk at Bridgeville upon veins which have not been opened, but which have been located by the drill.

In the Blanchard district a bed of red hematite has been traced for nearly half a mile across the lands of the company.

The following new discoveries have been recently made and not yet reported in print: A continuation of the limonite vein at Bridgeville at some distance from the present workings ; a vein of brown ore upon the lands of the company, purchased from Grant Bros., situated near the main road ; at a distance of several hundred feet from the last mentioned an ore body of limonite, which here attains a thickness of 18 feet as penetrated by the drill ; a small vein of red hematite, comparing favourably in quality with the other red hematites of the district, upon the Blanchard area of this company.

Coal Trade in Pictou County.

Present demand very dull. Although the port of Pictou has been open from the 1st April shipping has not ventured in. A stray cargo or two only has been loaded. The Drummond Mine has been busy banking preparatory to filling their large contracts up the St. Lawrence. The Acadia Co., so far as known, have made no contracts in Quebec.

Quebec.

It is reported that Mr. George R. Smith, late of the Ingersoll Rock Drill Co. of Canada, has been appointed manager of the Bell's Asbestos Company's mines at Thetford.

The annual general meeting of the Asbestos Club was held in the club house, Black Lake, on the 28th inst., when the officers for the ensuing year were elected and other business was transacted. A report of this meeting will appear in our next issue.

Mr. J. Lainson Wills, F.C.S., has severed his connection with the General Phosphate Corporation.

Templeton Notes.

The Templeton Asbestos Co. are now grinding their short fibre asbestos at Buckingham through the Frisbee Lucop mill. The cost of separating by this process is much cheaper than by the fibreizing plant process. Mr. Circkel, the manager, has reduced the gang to about 18 men.

The East Templeton and District Mining Syndicate intend increasing their staff by 70 men, which will give them a force of about 130, including cobbing boys. The winter output, now at the river front awaiting shipment, is about 500 tons 80% and 900 tons 70%.

The Electric Mining Co. has been working 22 men since the fall. Their monthly output has been from 100 to 125 tons.

The Haycock mica property, comprising 1,000 acres, together with a stock of cut and rough material, was sold this month to Watters & Co., Ottawa ; consideration, $38,000. Operations have been commenced by the new purchasers.

The Canada Industrial Co. are working 12 men on their property on the 8th concession of Templeton. Considerable high grade phosphate has been taken out and delivered at the station through the winter.

The latest offers from Hamburg for 80% range from 10¼ to 10¾. Several straight offers have been made this month at 10½, without takers.

Portland West.

Messrs. Allan & Fleming have opened up several new shows on their property on the 4th range. The quality of the phosphate is very high grade, averaging from 84% to 86% and almost free from impurities.

GOLD MINING SUPPLIES.

The principal depot in Nova Scotia, carrying the most complete assortment of first-class goods, is

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41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,

Halifax, N.S

Ontario.

Hastings County.

Mining operations in this section promise to be brisk this season. President Campbell, of the Standard Asbestos Co., owning the Bull Actinolite Mines, writes under recent date that they will begin active operations soon.

The Peebles Actinolite Mines are also expected to be operated this season.

It is said that the new management of the Central Ontario Railway will take steps early this spring to operate in iron mines at Coe Hill, and that large shipments of ore will be sent to Cleveland.

Sudbury District.

The Reduction Works Co. at Nickel City will go into liquidation in a few days. It has expended some $12,000 in hard cash here and are over $4,000 in debt. "Such an awful hungle of mining work was never seen before in this world," says a correspondent of the Sudbury *Journal*.

Mr. J. Robinson has sold Lot 1, in the 5th Concession of Hallam, to the Duluth Nickel Mining Co. for $5,000 cash.

Port Arthur District.

Arrangements, we understand, are now in progress for the active development of the deposits of native copper upon Lots 4 in the 2nd and 3rd Concessions, and the silver bearing lode traversing diagonally throughout mining location 52B and 54B in the 3rd and 4th Concessions of Crooks. These properties have been examined and favourably reported on by outside experts, and as their yield in silver and copper is considered satisfactory the deal may be regarded as closed.

The Gunflint Lake Iron Co. will be incorporated immediately by John Paulson, O. D. Kinney and Marcus Johnson. The capital stock will be $100,000. This company owns property in Township 65, Range 4, and is located about two miles from the boundary line and 11 miles from the present terminus of the Port Arthur, Duluth and Western Railway, which line will be extended across the border this summer. There is a fine out-cropping of magnetic ore, and developments will be pushed at once. Paulson is an experienced Minneapolis mining man, and has been all over the Gunflint country.

Kingston District.

A large deposit of "asbestine" or fibrous talc in Addington is attracting considerable attention from paper manufacturers and others. The mineral is similar to that of Gouverneur, N.Y., but the deposit is much larger and will be very easily worked.

An American firm is negotiating for the Effingham mica mine. If it obtains the property, it will equip it with steam plant, etc., and work it energetically. It consists of two large feldspathic dykes, carrying a fine quality of tough white mineral. The feldspar is suitable for pottery purposes. On the same property is a large quartz vein, carrying free gold, which they also intend to prove, and if ore exists in paying quantities, erect a mill. A 45-ton shipment of amber mica went from here last week.

The Amey mica mines, near Wilbur, are now operated under the management of S. Cordick.

British Columbia.

Nanaimo District.

The No 1 Shaft, back of Departure Bay, in the big bend, which was closed down some time ago, owing to the influx of water, is to be reopened. New and improved machinery has been obtained and placed in position, so that the inrush of water will be kept in control.

Owing to the slackness of the coal trade, it is stated that the Dunsmuirs intend reducing the number of men employed in the mines at Wellington. It is expected that about 150 men will be laid off ; if this is not done the mines will be worked only half-time during the dull period.

Some Nanaimo parties are at work near the old Douglas shaft at South Westminster, prospecting for coal. They are sinking a shaft directly through the croppings of lignite which were first discovered, and are confident of striking good coal. Being practical miners, they are familiar with all the indications which are to be found in the vicinity of coal deposits, and those interested in the discovery of coal on the south side of the river are more hopeful than ever since these men have started prospecting. The shaft of the South Westminster Coal Company is now down a considerable distance, but the hardpan has not been got through yet.

The pay days for the employés of the East Wellington Coal Co. have been altered. In the future instead of semi-monthly pays, wages will only be paid on the 15th of every month.

The new Vancouver Coal Company has struck the lower seam on Protection Island, and found it four (4)

feet thick of superb quality—roof and floor excellent. The value of this discovery to the Company can not be over-estimated.

The Company will make preparations for working both seams. The top seam will be worked to a certain distance first, and then the lower seam will be started on. Both seams will be worked right along in this way.

The coal exports for March, were :—

	Tons.
New Vancouver Coal Company.....	25,539
Wellington Colliery.....	19,037
East Wellington Colliery.....	2,832
Union Colliery.....	8,660
	56,068

The transfer of the Tumbo Island Coal Co. to Messrs. Green & Watelet was announced some time ago. On the 21st January last, Mr. P. Watelet arrived in Victoria, and at once proceeded to the property and commenced development work. He has continued his arduous labors ever since, and a few days ago was rewarded by discovering a seam of coal at a depth of 60 feet, and running a considerable distance from south-east to north.

The works for the sinking of the shaft, etc, are on the south side of the island, about 50 feet from high water mark, with ample harbor accommodation, so that the shipment of the black diamond will be comparatively inexpensive. Operations have been progressing wonderfully, more than 50,000 square feet of rock having been blasted, and a shaft of 10x12 sunk to a depth of 60 feet. The machinery is all in position, and Mr. Watelet is delighted with the prospects, and hopes soon to commence the shipment of coal From the position of the mine and the quantity of the coal, it is safe to predict a large output and a cheap article.

Nelson.

(From The Miner).

Two shifts of men continue development work on the main tnnnel of the Silver King, which is now in 854 ft. The character of the ore remains unchanged. John McDonald, the secretary, has gone to Spokane Falls to receive instructions as to the contemplated increase of the working force.

Next to the Hall mine group of claims on Toad mountain there is no property in the district that presents a better showing for the amount of development work that has been done on it than the Umatilla, Lizzie C, and Uncle Sam on Mineral Mountain, about two miles behind Nelson. Tom Collins and his partners have been working all winter driving a tunnel on the Lizzie C., about 300 feet below the old shaft. The tunnel, which will be 220 feet in length when completed, is now in 120 feet, and will tap thc shaft at a depth of 150 feet. The rock in the face at present is diabase schist heavily mineralized with iron and fine-grain galena. The tunnel will be finished in about 75 days, and provided the character of the gangue remains the same, it will establish the group as a first-class concentrating proposition. The bottom of the shaft is in solid mineral, averaging $42 per ton in silver, lead and gold.

John Macdonald, secretary for the Hall mine-owners, has returned from Spokane Falls where he met Mr. Croasdaile. Although the property has not changed hands, there will yet be a considerable increase in the number of men employed in development work as soon as the season opens. The rule of forbidding visitors to inspect the property will be enforced as vigorously this year as last, and absolutely no outsider will be admitted to the mine.

William Lynch, one of the prospectors who discovered the first mineral in the Slocan district, has given a working bond to a syndicate of Spokane Falls moneyed men, represented by S. K. Green, on a sixth interest in the Don Juan, and a quarter interest in the far-famed Washington claim, for 90 days. The price mentioned in the bond is $1 and other valuable considerations—the "other valuable considerations" being currently reported to be $20,000. W. E. Murray has sold a fighting interest in the latter claim to T. J. Jefferson, of Spokane, for $250.

Although the Dandy may not have the same fabulous amount of mineral wealth conspicuous to the naked eye that is to be seen on its neighbor to the southeast, it has nevertheless been at last developed to a stage that makes it a matter of absolute certainty that it will become in the near future one of the greatest ore-producing mines in the Kootenay Lake country. Ever since the middle of January last, when the first faint streak of gray copper was struck in the crosscut to the west of the main tunnel, every blow of the hammer has shown the property up better than it ever was before. The character of the ore has been gradually changing—gradually becoming more and more similar to Silver King rock each week, thus giving color to the supposition that the two claims would soon be blasting identical ore. That this theory was correct is at last proved by the fact that peacock-copper is continuous in the face of the south drift, dipping towards the Silver King. The strike was made at a depth of 200 feet, about 40 feet east of the old shaft—indicating that the vast body of high-grade bornite on the Silver King is continuous on the Dandy, but further down. The ordinary country rock through which the drift has been run, assayed 43 ounces in silver and 7 per cent. in copper. A. M. Esler who has employed the shift working there all winter, was in Nelson this week, but was unable to get up the hill on account of the snow. He had, however, specimens from the face brought down, and left on Friday's train more fully convinced than ever that the Dandy will be a great mine. Mr. Esler expects to be back in Nelson about the first of next month, to make arrangements for increasing the working force, and says that just as soon as the mine is sufficiently developed a concentrator will be running on Giveout Creek.

The Lendrum-Retallack-Watson interest in the now famous Washington claim in Slocan district—five-twelfths—has been bonded by A. E. Jefferson, of Spokane Falls, for $20,000

J. R. Tool, of Anaconda, Montana, came in, last Sunday, to inspect the Skyline on behalf of the McCune company, to report before the final payment for the property is made. He shipped three sacks of ore for test.

Development work is going on steadily on tbe Silver Queen, and the results are of a very encouraging nature. The shaft has been sunk about ten feet, and at the bottom the ledge is between six and seven feet wide. "Jim" Mack is the acting superintendent.

Ed. Croft, superintendent of the Neosho, reports having closed down the mine on account of water. The shaft is down 100 feet with the bottom in rich black-sulphurets. An effort will probably be made to keep the water in check by means of a windlass mill until the mine is thoroughly opened up.

A syndicate of English and Victoria capitalists have procured a working bond on the Whitewater gold mine on Rover creek, about 10 milcs from Nelson. The purchase price is $90,000. It is the intention to place a stamp mill on the ground as soon as sufficient work has been done to warrant the outlay.

The tunnel on the Grizzly is in about 300 feet. The rock is not as good as it has been, but still it is good enough.

The Hanna and Denver City mineral claims in the vicinity of the Queen, have been sold, through R. G. Tatlow, to coast speculators.

W. W. Sprague, the tenderfoot who sold the Tenderfoot last year for $7,500, brings good news from Tacoma. He says that the Tacoma smelter has proved a great success, and that W. R. Rust, the manager, has expressed the opinion that the ore from the Kootenay lake country— being a shipment from the Neosho and No. 1 in Hot Springs district—was among the best he had ever handled. A mining exchange has been established there, and specimens from this part of the continent are solicited. The exchange is located on A street in the neighborhood of the Hotel Tacoma. Mr. Sprague says that a number of mining men with money are there waiting for the season to open, they being under the impression that this section is under two feet of snow. They will not believe there is no snow in Nelson.

CANADIAN COMPANIES.

Hamilton Natural Gas and Mining Co. (Ltd.)—Gives notice that application will be made under the Ontario Act for incorporation to hold, work and sell land containing natural gas, oil, mineral waters, and to lay pipe lines for natural gas, oil, &c., in the County of Wentworth. Head office, Hamilton, Ont. Capital stock, $50,000 in 5,000 shares of $10 each. The applicants are : Thomas H. Pratt, merchant ; John H. Tilden, iron founder ; Lewis Springer, County Registrar ; Charles E. Newberry, farmer ; Henry Carscallen, barrister ; John Milne, iron founder ; John E. Parker, manufacturer ; Edwin D. Cahill, solicitor ; Chas. R. Smith, secretary of the Board of Trade ; Joseph Heron, merchant ; Alex. Gartshore, manufacturer ; George H. Bisby, merchant ; Edgar P. Wingate, civil engineer, and William Male, veterinary surgeon ; all of the City of Hamilton, Ont.

The West York Natural Gas and Mining Co. (Ltd.)—Will apply for incorporation under the Ontario Acts. The object of the company is to hold, work and operate land containing natural gas, oil and mineral waters, and to lay pipe lines for natural gas, oil, &c., and to produce electricity for light, heat or power, in the Township of York, Ont. Head office, Toronto. Capital, $500,000 in 5,000 shares of $100 each. Those applying are : Joseph E. Stonage, of Weston ; John P. Jackson, agent, Weston ; Frank Andrew Fleming, agent, Toronto ; Edward Eagle, Weston ; and Ernest Heaton, barrister, Toronto Junction.

The Saint Nicholas Nickel Mining Co. of Ontario (Ltd.)—Gives notice that application will be made under the Ontario Acts for incorporation to explore for, mine, smelt, treat and refine, sell and export copper, gold, silver, iron, nickel, lead and other ores in the Province of Ontario. Head office, Toronto. Capital stock, $500,000 in 50,000 shares of $10 each. The following are the names and addresses of the applicants : Isaac F. Toms, judge, Goderich ; Henry W. C. Meyer, Q.C., Wingham ; Henry Lowndes, wholesale merchant, Toronto ; John Segsworth, wholesale merchant, Toronto ; Richard Caddick, barrister-at-law, Toronto ; Arthur Wyndham Harrison, stock broker, Toronto.

Black Jack Quartz Mining Co. (Ltd.)—There is delinquent upon the following described stock, on account of assessment levied on 8th February and assessments levied thereto, the several amounts set opposite the names of the respective shareholders, as follows :

G. A. Veith,	200	shares.....	$45 00
C. Hageman,	1,500	"	31 38
C. Paulsen,	600	"	13 37
A. Barlow,	400	"	3 00
Thos. Robb,	200	"	4 40
Wm. Forrest,	400	"	9 00

And in accordance with law, so many shares of each parcel of said stock as may be necessary will be sold at Barkerville, on Saturday, the 7th day of May, at 2 o'clock p.m., to pay said delinquent assessments thereon, together with the costs of advertising and the expenses of the sale.

West Kootenay Mining Development Syndicate (Ltd.)—This syndicate has been formed in London for the purpose of leasing, purchasing or otherwise acquiring mineral properties in British Columbia, Canada, or elsewhere, and to develop these properties with a view of re-selling them to existing companies or forming other companies to work the same. Authorized capital, £10,000 sterling, divided into 9,800 ordinary shares of £1 each and 100 founders' shares of £2 each ; payable 2s. 6d. on application, 2s. 6d. on allotment, and the balance in calls not exceeding 5s. per share, at intervals of not less than two months. In a division of profits the ordinary shares will receive a preferential dividend of 8 per cent., and, subject to provision for a reserve fund, the balance will be equally divided between the ordinary and founders' shares. Directors : W. Pellew-Harvey, Golden, B.C. ; Peter McCarthy, Q.C., Calgary, Alta. ; Alfred Mowbray-Waite, London, Eng. London Office : A. M. Waite & Co.. 16 St. Helen's Place, London. Canadian Office : W. Pellew-Harvey, Golden, B.C. The company has obtained a concession to an argentiferous galena property known as the Gladstone location, situate about three miles from the town of Illecillewaet. Four samples of ore taken from the "Gladstone" give the following returns :

"No. 1 Galena. Out of tunnel.	Silver, 93 ozs. per ton. Gold, $9. Lead, 70·31%.
"No. 2 Galena. Out of shaft at bottom.	Silver, 293·95 ozs. per ton. Gold, nil. Lead, 68·72%.
"No. 3 Galena. From Main Lode.	Silver, 70 ozs. per ton. Gold, $3. Lead, 70%.
"No. 4. Grey Copper. Forming stringer to lode in shaft.	Silver, 58·7 ozs. per ton. Gold, $2.50. Lead, 11·54%.

A contract has been entered into, dated the 14th day of April, 1892, and made between Alfred Mowbray-Waite of the one part, and William Littaur, on behalf of the Syndicate, of the other part, and the same, together with the concession above referred to, dated 12th March, 1892 ; the report of Mr. W. Pellew-Harvey, dated July 7th, 1891, and the Memorandum and Articles of Association can be inspected at the registered offices of the Syndicate.

British Phosphate Co. (Ltd.)—This company (practically an offshoot of the Anglo-Continental Guano Works Co.) has been registered at London on the 18th ulto., with a capital of £20,000 stg., divided into 4,000 shares of £5 each. The objects for which the company is established are : To purchase or otherwise acquire, either absolutely or conditionally, and on such terms and conditions as may be deemed expedient, any phosphates, ores, coal or other mines, lands, hereditaments and premises and real and personal estate situate in Canada and elsewhere, and all or any mining and other rights and privileges in any way appertaining to or connected with all or any such mines, lands, hereditaments and premises, or any part thereof respectively, etc. The first subscribers are ,

Ad. Horney, merchant, 15 Leadenhall Street, London.....	20 shares
Hermann Voss, merchant, Holstein House, Beckenham, Kent.....	20 "
W. H. Hutchinson, merchant, Fordwych Road, Brondesbury, London.....	20 "
E. Watts, accountant, Ivy Dene, Dornton Road, South Croydon.....	1 "
Max Hirsch, cashier, 29 Ickburgh Road, Upper Clapton.....	1 "
Otto Trübenbach, merchant, 56 Ferdinand Strass, Hamburg....	20 "
Gustav Martens, merchant, 25 Rue du Robinet, Antwerp.....	20 "

The company has taken over the Squaw Hill and Ætna phosphate properties, formerly operated by the Anglo-Continental Co., in the Township of Buckingham, County of Ottawa, Que. The Canadian manager is Mr. J. Burley-Smith, Glenalmond, Que.

The Buckingham and Lievres River Railway Co.—Messrs. Hatton & McLennan, solicitors for the appli-

cants, give notice of an application to Parliament for an Act with power to build, construct and operate a railway from a point at or near the Village of Buckingham, in the County of Ottawa, extending along the River Lievres, upon either side, northerly to White Fish Lake, and thence along the River Lievres to its source ; with power to make and enter into running arrangements with other railway companies. This line, when constructed, will be a great stimulus to the development of the mineral industries on the banks of the Lievres River.

A Safety Brake for Hoists.

Mr. Robert Middleton, of Leeds England, has favoured us with particulars of his patent "grip" safety apparatus for hoists and suspended lifts or cages. The method of action of the apparatus will be readily understood. It is fixed at the top of the well over the hoist, and the rope which passes over the grooved pulley is fastened, after passing through the grip, to the top of the cage. The other end, after passing under a pulley fixed on the bottom of the hoist well, is fastened to the underside of the cage or in some cases to a balance weight. The speed of the cage, therefore, regulates the number of revolutions of the grooved pulley. This pulley in its turn drives the regulator. When the latter exceeds the desired speed the strikers compress the springs. and flying out come in contact with the lever and shaft. This shaft and levers are held in position by the simple contrivance of passing a piece of copper wire through the lever and into the casting. The force of the blow from the striker shears the wire, and the "grip" comes at once into action. When once the rope is in contact with this, the greater the pull, and the heavier the weight, the more securely is the cage held. On reversing the hoist the "grip" at once relaxes its hold and sets the rope free. A new piece of wire inserted in the hole resets the apparatus, and the hoist is ready for work in a few minutes after the action has taken place. The rope, it is stated, is undamaged in any way. At a test trial, we are informed this apparatus gave most satisfactory results. The cage of the hoist was disconnected from its hoisting ropes, and propped up from below. Forty 56 lb. weights were then put into the cage, the props struck, and the cage was stopped and held fast in the space of 14 inches. The same result practically took place with the cage empty. This apparatus can be connected direct to the cage itself, or can be used as a certain means of bringing into action any other kind of safety apparatus fixed on the cage and acting on the slides of the hoist well. No hoist cage can, it is asserted, fall with or without occupants with this apparatus, and its action takes place without waiting for a breakage of parts before being put into motion.

The Lechesne Nickel-Steel Process.

A foreign exchange states that the Ferro-Nickel Company, of France, has succeeded in obtaining nickel iron and steel containing a large percentage of nickel, and participating in the remarkable properties of this metal (non-oxidizability, brightness, &c.), and susceptible of being substituted for it in a large number of uses from which it has hitherto been excluded by the high price of pure nickel.

In continuing the series of ferro-nickels, the lowering the percentage of nickel below 25 per cent. forms a category of metals, the new properties of which constitute a special class of altogether peculiar interest. We have here no longer alloys of a somewhat high price, capable, on account of their richness in nickel, of replacing the pure metal, but metals comparable to iron and steel, and in which the intervention of even a small proportion of nickel modifies the constitution of the metal without (in low percentages) materially increasing its cost, and gives to the iron and steel employed an improvement of quality which is very remarkable.

The process consists in the simultaneous employment of manganese and aluminum with or without addition of carbon, under the form of charcoal, or metallic or ferro-cyanides. In the case of manganese, either pure manganese is used or oxides mixed with a reducer, or ferro-manganese. In like manner for aluminum, either the pure aluminum is used or a mixture of iron and aluminum. The nickel itself is introduced either in the form of pure metal or in the form of malleabilized metal, or crude metal more or less rich in nickel, proceeding either from the treatment of nickel ore up to the point of elimination of the iron, or from previous fusions of cast iron, wrought iron or steel with nickel.

With regard to the carrying out of the process, current experience has indicated the following method as the most suitable for obtaining a good result. It is preferable to take the pure nickel or mixed with iron at the outset of the operation. The manganese, under whatever form it is employed, mixed or not with the chosen carbonizer, is added in one or two additions in the course of fusion. The quantity of aluminum necessary is projected at the close of the operation in the bath of metal or in the casting ladle.

With regard to fusing apparatus use is made of that which is ordinarily employed in metallurgy—crucibles, reverberatory furnaces, converters, Siemens furnaces, cupolas, &c. Experience has shown that in the quantities of the intermediary agents the best results are obtained, with proportions of aluminum varying from a ten-thousandth to about one-thousandth, and of manganese varying from one-thousandth to about two hundreths per kilogramme of alloy to be produced according to the quantity of nickel and the quality of the metal to be attained.

From the point of view of the carbonizing agents it has been ascertained that according as it is wished to obtain metal soft or hard, carburetted or not, with the same percentage of nickel, carbon or cyanide must be used in variable proportions. In this way it is possible, by the employment of ferro-cyanide with manganese and aluminum, without even the addition of nickel, to transform the iron into a tempered steel naturally susceptible of furnishing turning tools without tempering and by direct forging.

We shall give for instance the best quantities for obtaining on the hearth a ferro-nickel with 5 per cent. of nickel, starting with a nickeliferous pig. The work is proceeded with as for the manufacture of steel, and after partial or complete decarbonization, according to the quality of the metal to be obtained, metallic manganese or ferro-cyanide of manganese is added, and at the moment of tapping the aluminum is added, either in furnace or in the casting ladle. For 500 kilogrammes of alloy the proportions are as follows :—

	Kilos.
Pig, with 25% nickel..	100
Soft Iron or Steel	400
Ferro-manganese, with 75% of manganese	3
Aluminum	0.25
Total	503.25

The character of these various alloys is as follows : These metals possess a much more perfect homogeneity than that of iron or steel obtained by the usual processes, and consequently they have the qualities of malleability, ductility, tenacity, elasticity, etc., to an altogether superior degree. The coagulation of the ingots is very rapid and bubbles are avoided. Ferro-nickel, with 25 per cent. of nickel, whatever the qnantity of carbon, does not take tempering, but according as the proportion of nickel diminishes, the property of being tempered reappears and goes on asserting itself until, with proportions of 7, 5 and 3 per cent. below, we obtain alloys capable of being tempered according to laws analogous to those which govern the tempering of ordinary kinds of steel. The proportion of carbon, the distribution and special forms of the carbon in the cement and the metallic core (modification due to the presence of the nickel), the fall of the temperature between the heating and the cooling, and the rapidity of the cooling. combine to produce various degrees of hardness, as could be predicted by the complete analysis made according to the very exact methods recently discovered, and by the remarkable investigations into the constitution of steel which have appeared of recent years.

The influence of the agents of malleabilization in the application of these processes is demonstrated by the fact that, when these agents are employed without the intervention of nickel, the products obtained present much superior qualities to those of iron and steel treated by the ordinary processes.

Hauling Coal by Electricity.

Following close upon the experiments of the Delaware, Lackawanna and Western Company, in Scranton, comes news of the successful experiments that have been made with electricity for hauling purposes by the Hillside Coal and Iron Company. At the Erie colliery of this company an electrical hauling plant is in operation. It consists of a 60 horse-power Thomson-Houston generator. The engine and dynamo room are in charge of the engineer and assistant who operate the other mining machinery. The electric locomotive is run by one man who is assisted by a boy in making up the trains and turning the switches. This locomotive displaces 7 mules and 3 drivers. During a period of 112 days the average number of cars delivered at the shaft bottom by the locomotive was 559, against 526 per day delivered by mule haulage, much time being consumed by waiting at the bottom of one shaft for empty cars. Thus far it has shown that it will increase the daily output to 700 cars per day. To deliver 700 cars per day of ten hours, the time of running the locomotive is 5 hours and 30 minutes, leaving 4 hours and 30 minutes for contingencies. The total distance run is 21.28 miles, and the locomotive is reversed 232 times. Besides this hauling power the current is used for lighting purposes, so that in every department of the work there is abundant light. Altogether the company managers have found the new system a great improvement over the old, and they intend in the near future to extend it to their other works.

INSTEAD of the suggested one pound notes, Sir Henry Bessemer proposes an aluminium coin. He points out that the new metal may be slightly alloyed so as to harden and increase its durability, and at the same time raise its fusing point, and thus render the casting of it in plaster moulds quite impossible. The specific gravity of aluminium is 2·56, while that of silver is 10.47, so that an aluminium coin of the exact size and thickness of a common florin would weigh a minute fraction less than a silver sixpence ; hence, if taken from the pocket in the dark it would be instantly recognised by its extreme lightness, and could never be mistaken for any coin made of gold or silver, while the great weight of all lead or pewter alloys, which are capable of being cast in plaster moulds, could never be passed off as aluminium coins, however their external surface might be coated or coloured in imitation of that metal.

The Value of Bore-Hole Records.

The State Geologist of Missouri, in his preliminary report on the coal deposits of that State, appreciates the value of all these local records as a means of assisting him formulating a State geological map, and we cannot do better than present his own words on this point. He says : Of especial value in this report are the records of the various deep shafts and drill holes which are included. They are furnished by many different individuals, and, in each case where the results are quoted, recognition of this assistance is expressed. With a few exceptions, the individuals and corporations of the State have generously contributed such results in a free, public-spirited manner. The importance of furnishing such records to the survey, where they may be kept on file for ready reference, cannot be too strongly emphasized. Hundreds of such holes have been put down in the State for various purposes, and from comparatively few of such are reliable results now available. Such holes are generally sunk for a definite purpose, and when that end is reached it occurs to few that the results may still be valuable for other purposes. But this is almost always the case. Whether a thick coal be encountered or not a good record establishes a series of facts concerning the geology of the locality, and is, hence, valuable. For instance, the record though *apparently* barren of results of economic value, may show that the drilling stopped in a certain limestone, which, by comparison with a record obtained elsewhere, we know is 20 or 50 feet, as the case may be, above a certain valuable coal bed. Hence, from the study and comparison of these two records we are able to predict the probable existence of workable coal within a short distance of the bottom of the hole. Again, the hole may have penetrated rocks which we recognize as below any coal in the State ; and in this case the result is of general value in preventing further exploration below this depth. Only from the results of such deep drilling can the area of available coal in the State be exactly determined and the limits of the individual beds be defined, especially in those parts of the State where the coal beds are deep beneath the surface. The reason why records of value are not always attainable is, however, not only because of negligence on the part of those immediately interested to preserve them, nor yet because of refusal to contribute them. It is unfortunately the case that many holes have been put down by incompetent men, or by men who know merely how to handle a drill without having sufficient knowledge of lithology or geology to be able to accurately describe and record the descriptions of the rocks they encounter, or to interpret the meaning of all they pass through. In cases it is even worse than this, and the history of many a deep and expensive drill hole in the State shows evidence of trickery and bad faith on the part of the driller towards those in whose service he was supposed to be working. The uncertainty attending such work has thus brought disfavour in many localities upon deep drilling as a public enterprise, many having acquired the impression that only indefinite results of small practical value could be reached. This impression is wrong and unfortunate, for such work can and should be prosecuted by every progressive community in the coal regions which is anxious to determine the existence of coal beds and is anxious to have them developed. In view of these facts the survey suggests a possible plan of co-operation which, if adopted, would ensure a well conducted drill hole, a reliable record and an official report on the same, and would, at the same time, secure for the State complete results of the drilling in such condition that they can be unhesitatatingly used and will be entirely comparable. To any private individual or community desiring to have a *deep* drill hole sunk the survey could arrange to recommend reliable men whom the the individual or community can employ to do the work of drilling ; second, it could supervise this work, and last, it could furnish an official statement of the results of the drilling. In return for this service it would be required that the survey be allowed full and free use of the results for the benefit of the State. That this would be in every way a liberal offer, cannot be disputed. In addition to securing reliable results, the individual would, by this means, be put in possession of a report, which would be, as it were, negotiable. Being of an official nature, from an impartial source, others will place faith in it and will invest money on its authority, for purposes of actual development, where they would not do so were the report of a private nature, emanating from an interested source. If such a plan of co-operation were generally adopted, the State would soon have accumulated an invaluable mass of material from which it would be possible to outline, with a high degree of accuracy, the general limits of each and every coal bed in the State. From this the prospects of finding coal at any one point could be predicted, as well as its probable depth and thickness when found. Surely the attainment of such a condition of exact knowledge is worthy of our serious efforts.

The Copper Combine.—The latest information at hand concerning the new combination of the copper producers, is to the effect that the agreement has been perfected ; that all the American companies have assented to it, and that all that is now needed is to get certain foreign properties in. The allotment of annual production as finally decided upon is said to be as follows : Anaconda, 75,000,000 pounds ; Calumet and Hecla, 60,000,000 ; Quincy, 12,000,000 ; Parrott, 14,000,000, and the Clark-Bigelow properties—the Tamarack, Osceola, Kearsage, Montana, Butte and Boston, and others, 65,000,000, making an aggregate of 225,000,000. These figures represent a considerable increase over last year's total production.

A Remarkable Entombment.

In Geikie's *Geological Sketches at Home and Abroad*, we have the following remarkable instance of an entombment in a mine in the year 1825. The story runs somewhat as follows :

A creep (cave-in) came over the mine and scared the men out, but a miner named Brown happening to leave his jacket (a new one by-the-by) in his room, returned by himself to fetch it. During the time he was gone, a heavy fall occurred which shut him off from the only outlet there was left. It was 23 days before the rescuing party reached the man, but he was still alive and able to speak, and, after a few hours, to give some account of his terrible experience, without a particle of food and only mine water to drink. It seems that he never lost consciousness or belief that he would be rescued, as he could hear the workers approaching his place day by day. But in the end, as he grew weaker, he had stumbled across the road way and fallen in the position in which he was found. On bringing him into daylight, a sight never seen before, and never to be forgotten, presented itself. The coal-mine fungus had spread over the poor fellow's body as it would have done over a rotting log. His beard had grown bristly during his confinement, and all through the hairs the white fungus had taken root. On a friend pulling off the fungus threads, he pushed the hand aside saying, "Na, noo wad ye kittle (tickle) me ?" A more ghastly figure than he was could hardly be pictured. His face wore a strange sallow hue *like that of a mummy*. His flesh seemed entirely gone, nothing left but the bones, under a thin covering of leather-like skin. The doctor said he could distinctly feel the inner surface of the backbone on putting his hand over the pit of the stomach, so completely wasted away was he. However, the shock had been too much for him ; he only lived a few days. This poor miner's lower extremities were not human at all—for he was cloven-footed ; and this fact was calculated to make the traditional and superstitious Scottish miner not so sure whether this man, who might be said to have *risen from the dead*, was not the "deil" in disguise after all.

A tombstone bearing the following inscription marks John Brown's grave in the quiet churchyard of Dailly :

"In memory of
John Brown, collier,
Kilgrammie coal pit, by a portion of it having fallen in,
Oct. 8th, 1835,
and was taken out alive,
and in full possession of all his mental faculties,
but in a very exhausted state,
Oct. 31st,
having been twenty-three days in utter seclusion
from the world, and without a particle of food.
He lived for three days after,
having quietly expired on the evening of
Nov. 3rd,
aged 66 years."

Funding the Natural Gas Debt.—The Board of Natural Gas Trustees, of Toledo, O., in suggesting the funding of the natural gas debt of that city, made the following statement : "The immense drain upon the gas fields for the last 4 years has seriously affected the gas produced in the territory where most of the wells belonging to the city are located, and the rock pressure of the gas wells (which is the force by which the gas is driven into the pipe line), has diminished from 370 to 120 pounds, thereby very seriously diminishing the quantity which the pipe will carry, and we are now confronted with a shortage of gas for the supply of people who rely on us for a supply of that fuel, and without which there will be failure, not only to supply the needs of our people, but also of an income to increase the supply, and at the same time pay the debt incurred by the city in building the works. The trustees have territory comprising some 2,000 acres where the rock pressure is still undiminished, and where a reasonable expectation may be entertained of providing for the wants of the city, and there is more that is offered, and can be purchased, if the trustees were so situated financially as to obtain it."

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Mining Laws Affirmed.—The Supreme Court of West Virginia handed down its decision on March 22nd, affirming the constitutionality of the act recently passed by the legislature, regarding certain additions to the mining laws of that state. In accordance with the decision rendered by the court, employers are forbidden to issue scrip or checks to employes, such scrip or checks to be exchanged for goods at the store of the employer. The operators are likewise required to pay the miners according to the weight of coal mined, but before it is screened. This presumably settles these points once for all in the little Mountain State.

Another Mode of Making Briquettes.—The conversion of coal dust into fuel has for a long time been accomplished by various simple methods, differing but slightly in their details ; but it has recently been proposed, instead of the usual plan of using pitch to cement coal dust together to form briquettes, to resort to substances of a glutinous or a farinaceous character, these including those obtained from wheat, barley, rye or other cereal or vegetables, 5 per cent. to 95 per cent. of coal dust being found to constitute a suitable proportion. The mixture may be kneaded by hand and sets in a short time, so that moulding under pressure is not really essential, though moulding may be resorted to for securing rapid manufacture. The product is said to burn with less smoke than the ordinary briquettes, and it is claimed that, in the matter of cost, the new article is the more economical. Ashes, or refuse matter from coal fires, with or without fresh coal, may also be utilized.

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All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

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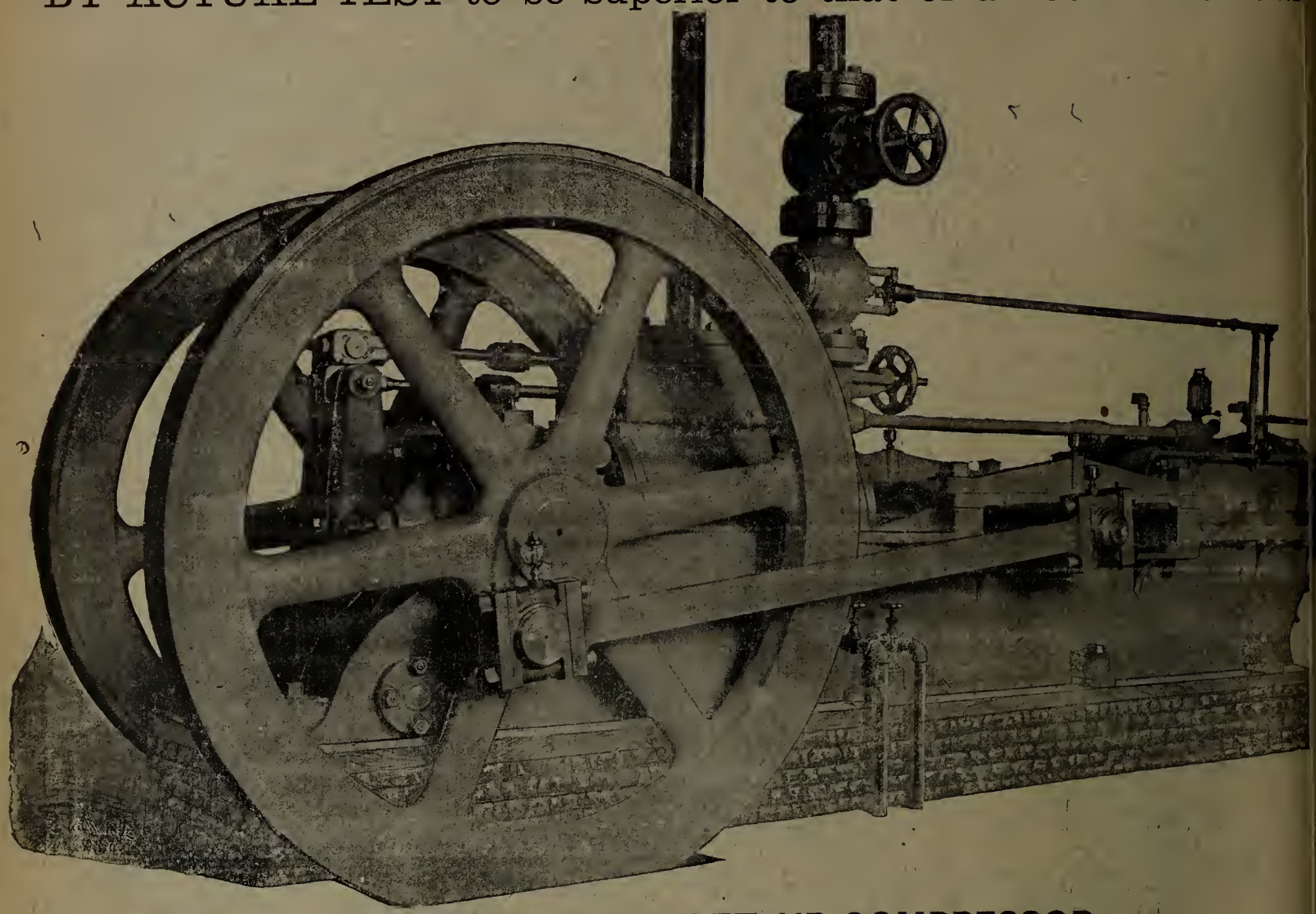

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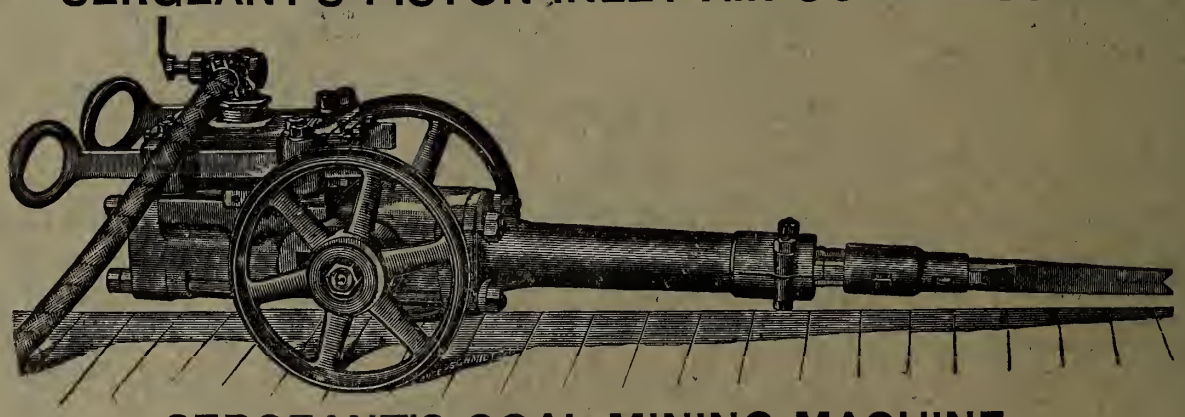

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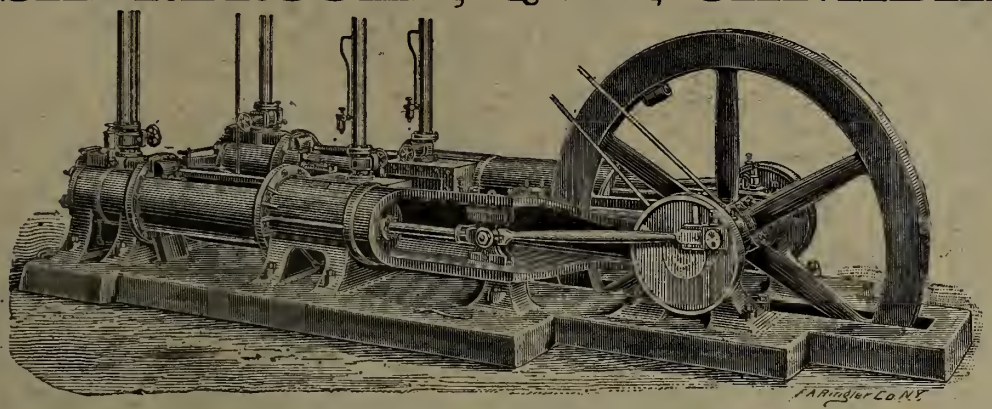

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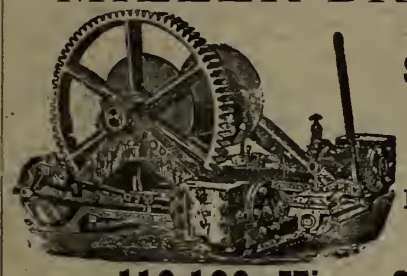

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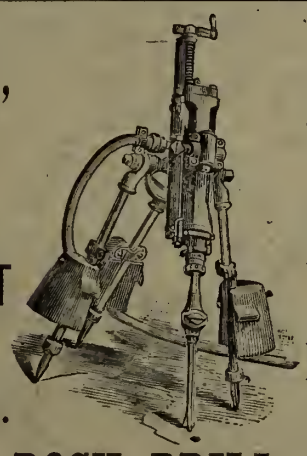

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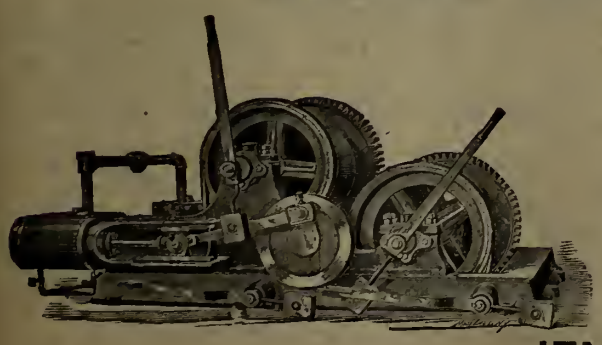

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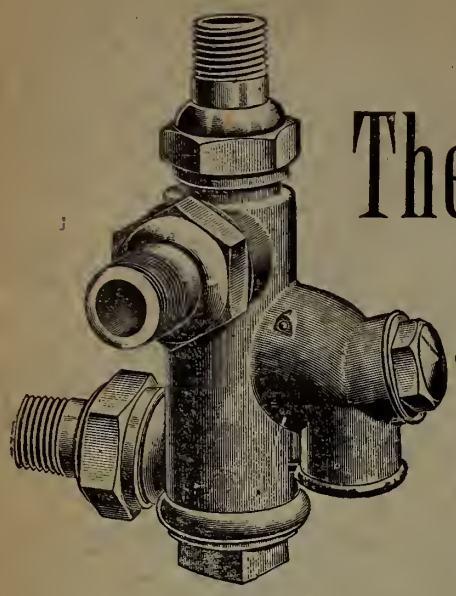

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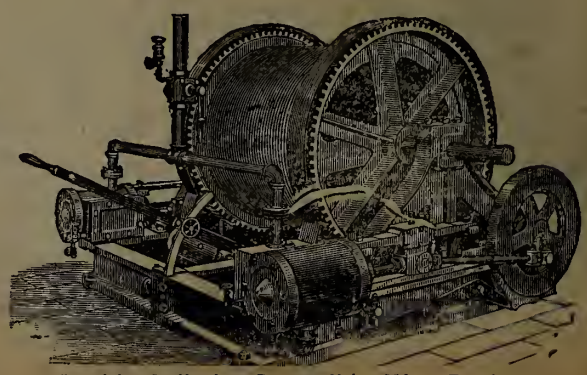

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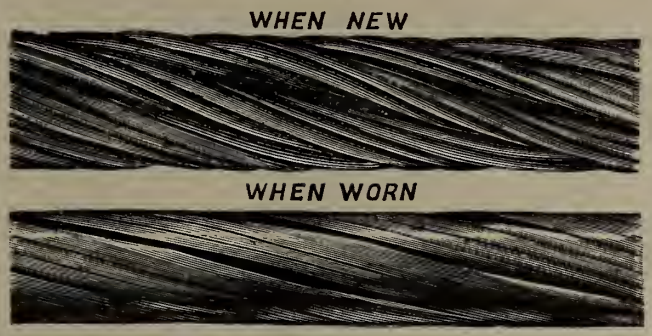

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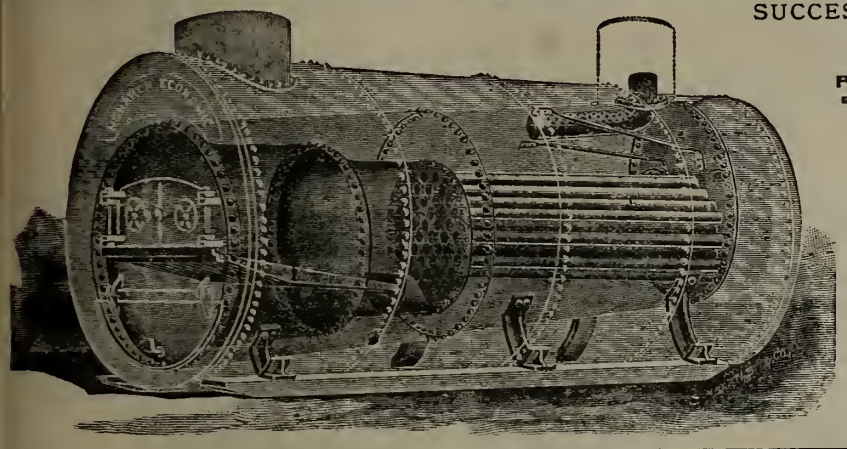

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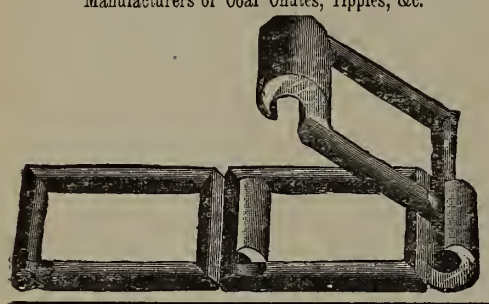

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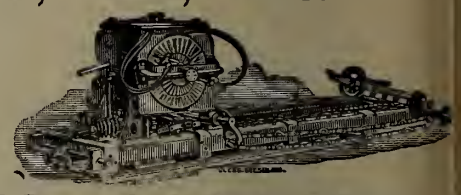

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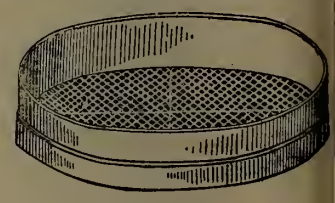

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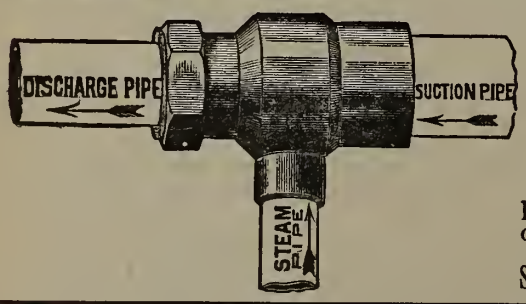

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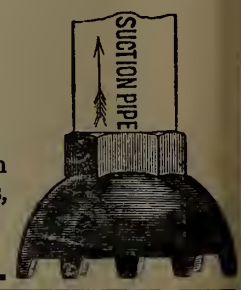

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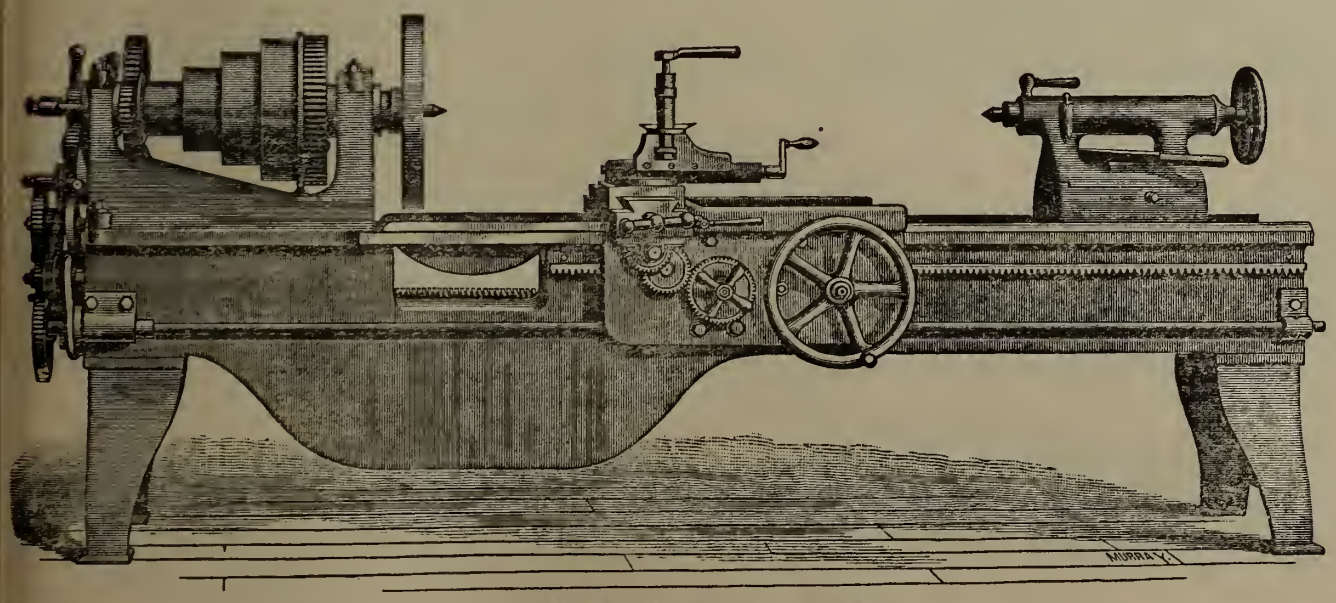

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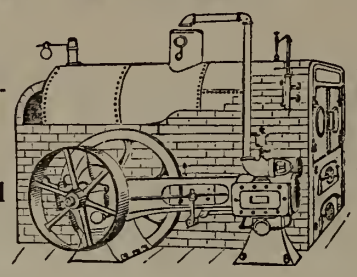

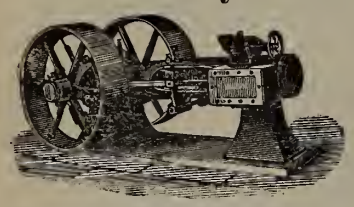

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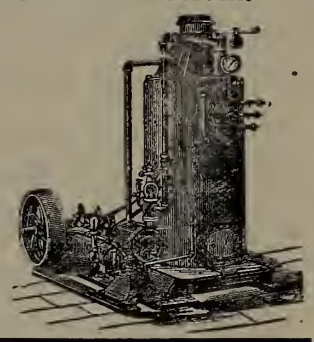

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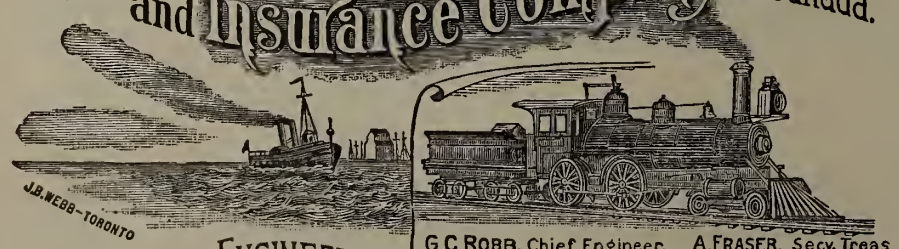

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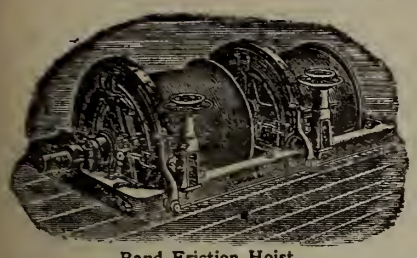

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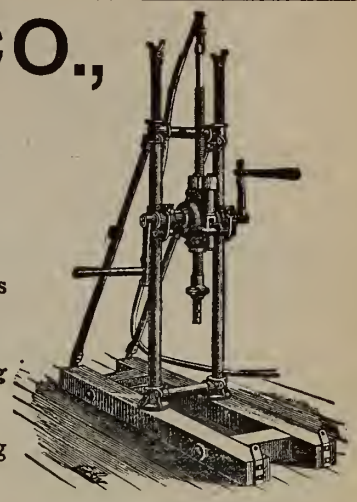

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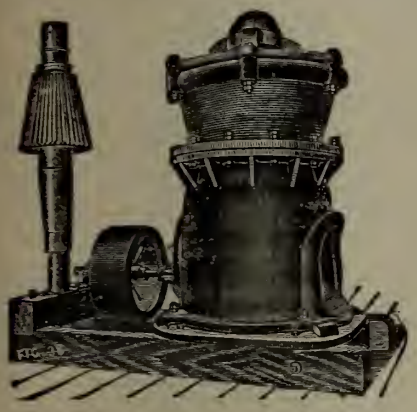

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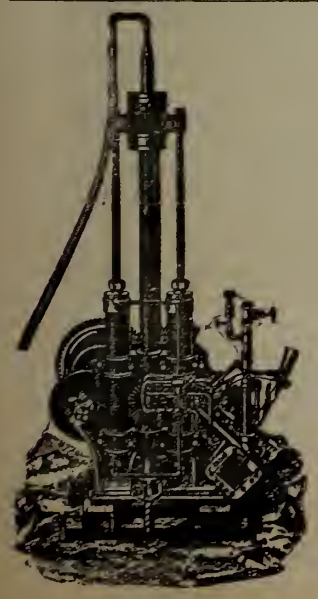

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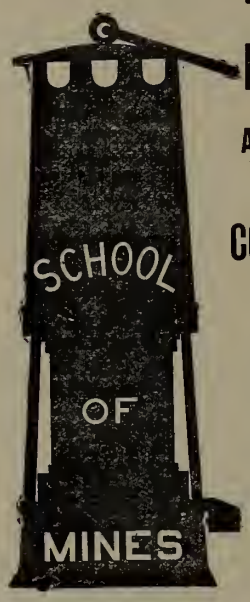

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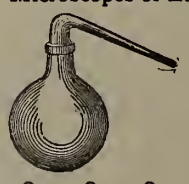

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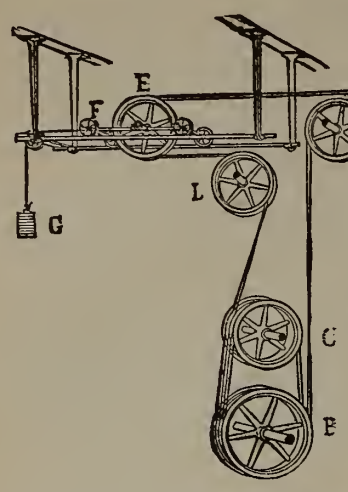

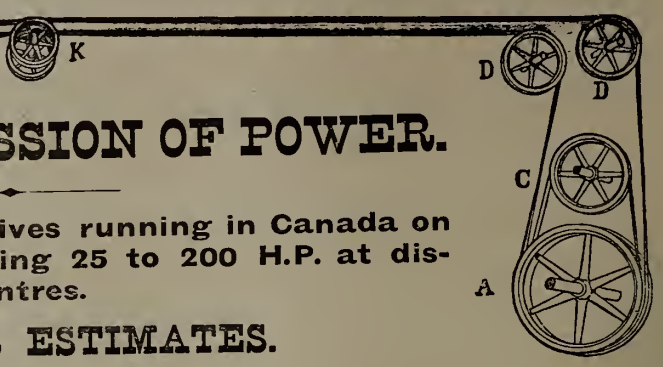

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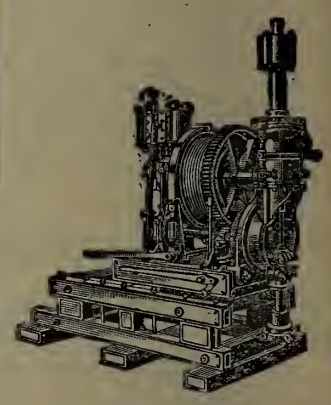

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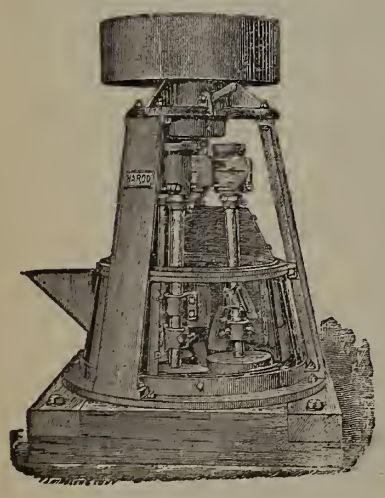

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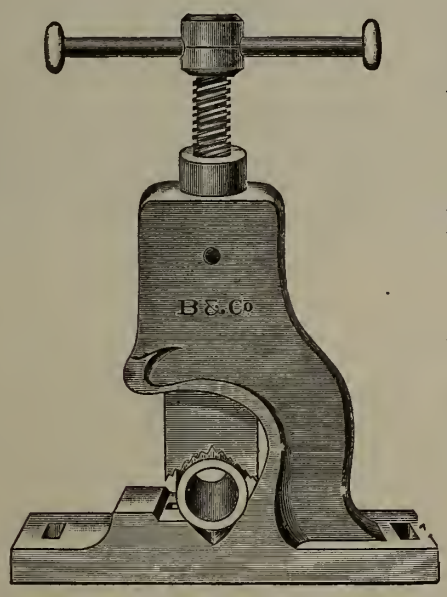

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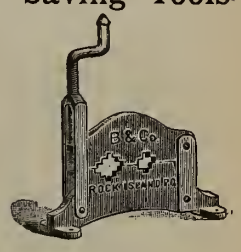

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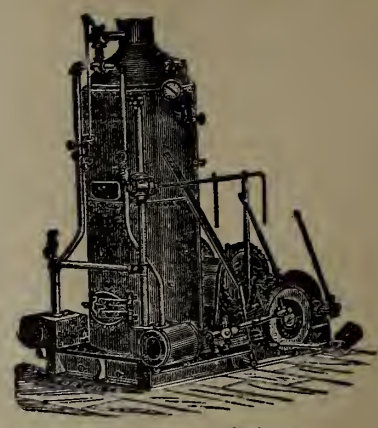

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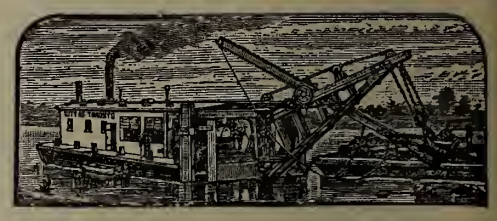

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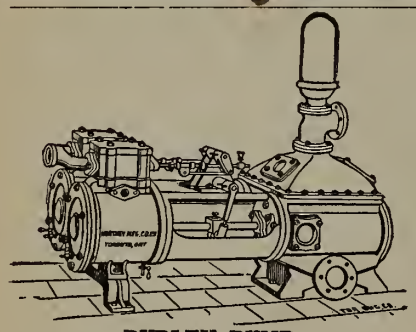

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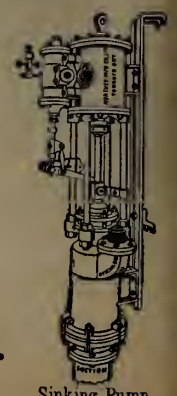

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CANADIAN MINING & MECHANICAL REVIEW

CONDUCTED BY - - - - - - B. T. A. BELL.

THE OFFICIAL ORGAN

—OF—

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THE UNITED MINING SOCIETY OF NOVA SCOTIA,

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THE GENERAL MINING ASSOCIATION OF QUEBEC.

THE following Resolutions of Council indicate beyond a peradventure the status of THE REVIEW as the exponent of the Canadian Mineral Industries:—

The Gold Miners' Association of Nova Scotia.

"At the annual meeting of the Gold Miners' Association of Nova Scotia, held at Halifax on 6th March, 1889, THE CANADIAN MINING REVIEW was adopted the official organ of this Association.

(Signed), B. C. WILSON, *President.*
G. J. PARTINGTON, *Secretary.*

The United Mining Society of Nova Scotia.

"Moved by Mr. R. G. Leckie, seconded by Mr. C. A. Dimock, That the thanks of the Society be tendered to Mr. B. T. A. Bell for his kind offer placing the columns of THE REVIEW at the disposal of the Society; and that THE CANADIAN MINING REVIEW is hereby appointed the official organ of the Society."

(Signed), H. S. POOLE, *President,*
H. M. WYLDE, *Secretary.*

The Asbestos Club, (Quebec.)

"Resolved: That THE CANADIAN MINING REVIEW is, by authority of the Members and Council, hereby appointed the official organ of the Asbestos Club."

(Signed), D. A. BROWN, *President.*
A. M. EVANS, *Secretary.*

The General Mining Association of the Province of Quebec.

At a meeting of Council held at Montreal on Friday, 6th May, 1891, it was moved by Captain Adams, seconded by Mr. R. T. Hopper, and resolved: That THE CANADIAN MINING REVIEW be the official organ of the Association.

(Signed), GEORGE IRVINE, *President.*
B. T. A. BELL, *Secretary.*"

OFFICES:
Victoria Chambers, 140 Wellington Street,
OTTAWA.

Vol. XI. MAY, 1892. No. 5.

The Increased Royalty on Nova Scotia Coal.

The Government of Nova Scotia are no doubt exulting over the success of their bill to increase the cost of production of coal in that province. And with reason, too, from their point of view; for it will give an increase of royalty of from $35,000 to $40,000, assuming the output of coal to continue as at present. Two and a half cents per ton increase of royalty! An outcry against this? why, it is absurd. The mine owners will never feel it, the public will willingly pay it, and moreover, the owners can well afford it. But can they? There comes the crux; thence springs the all-important question: Can the mine-owners afford it? With respect to the removal of the increase from them to the consumer, who will throw the first stone? Which company will advance the selling price and take the risk of being left out in the cold? Is the coal trade of Nova Scotia so profitable a one?—the coal trade generally so very desirable an investment that an additional two and a half cents per ton cannot affect it? Let us extend this enquiry into a much, a very much, older mining country, and let us see what the results are there. In a recent article in the Birmingham *Daily Post* reference is made to a "memorandum newly drawn up by the British Iron Trade Association," in which it is stated that "between 1877 and 1887 the gross amount of the mining profits in England and Wales assessed to income tax fell from £12,719,000 to £6,481,000, or little more than one-half," and it goes on as follows: "Assuming the capital embarked in the coal trade at the latter date to be not less than 100 millions, nearly as much more would be required to capitalize the other mining industries of the country, including ironstone, limestone, lead, copper, tin, etc., so that the average yield at the latter date mentioned would be little, if at all, in excess of 3 per cent. In 1873 the evidence given by several witnesses before the Coal Committee went to show that the average profits of the coal trade over a period of years had not exceeded 2½ or 3 per cent." That is surely a tempting profit! And how stand the figures in other mining countries? "In Germany, for instance, the average dividend paid upon a capital of 7¾ millions sterling, embarked in twenty-three of the principal collieries of the Westphalian district, was, during ten years, less than 2¾ per cent."

What of Nova Scotia coal mining? Is the Province and the Government to be congratulated on a very different result? Fortunately, there is reason to believe that coal mining in Nova Scotia is not at so low an ebb as in the countries referred to; but are the results generally so much better that they can bear to be pared? Will any conscientious investor, holding in view the risks of the serious accidents to which coal mines are unfortunately liable, and the fluctuating prices of coal arising from the keen competition in the trade; will any such express his satisfaction with a less rate of profit than double, nay treble, the amount mentioned in the memorandum referred to? It would seem that the Government of Nova Scotia have assumed that at any rate the profits will bear reduction, and they have therefore unsparingly applied the pruning knife. It is singular in connection with the action of the Government that Mr. Drummond, the representative of the miners' interest, should so easily have acquiesced in this infliction of an additional charge on the cost of production. It is singular that his usual "cuteness" did not suggest the query: What if the consumer will not pay the 2½ cents additional?—what in that case may be the action of the mine owners? May they not attempt to reduce wages? Pooh! if they *all* add it to the selling price where does the bugbear come in? This may be the course of thought, but let us ask where are the large consumers? Are they not locally in an advantageous position—in spite of the protective duty—to play off American coal against Nova Scotian; and what may be the result? Throw off by an increase of price the requirements of the Grand Trunk and Canadian Pacific Railways; let their contracts pass into other hands, and where is the alternative demand that will enable the mines to be operated on the scale of production they are at present?

The position, though evidently looked upon by the Nova Scotia Government as one of little moment, is a serious one. Apart from the practical results to be feared, there cannot be a doubt that the moral turpitude of their action will have a deterring effect on intending investors. Dr. Raymond has very ably expressed his opinion in this respect, and the letter of Mr. Odiorne, of Boston, to Mr. Poole, and by him read to the Committee of the Legislative Council, gives a direct confirmation of the views held by Dr. Raymond and all who have a practical knowledge of the cost and the profits of coal mining.

Mining Inspectors for Quebec.

The prosperity of a country is almost always the direct result of good government. One of the most important functions of government is the appointment of its permanent officials; and in the wise selection of the most competent and reliable men a minister shows his own fitness to govern.

From these officials, the head of a department gains the only reliable information, in detail, which can enable him to regulate and improve the ever-changing conditions of its internal economy.

Some of these require but little erudition beyond the three R's, and but little character beyond sobriety, steadiness, and honesty, for their fulfilment.

Others can only be creditably filled by men of cultivated intelligence and education, men who by special technical training and experience are the head of those with whom they have to deal, and the masters of the department they have to supervise—high-minded, honourable men, having a true sense of the dignity of their office and its moral obligations, and no self-interest outside that accruing from the faithful discharge of duty.

Mining inspectors should belong pre-eminently to the latter class, and as two such appointments are about to be made for the Province of Quebec, mining men are waiting the issue with interest.

It is known that the applicants are from three distinct classes of the mining fraternity.

Firstly—Professional mining engineers who are, or have been, engaged in developing the mines of the Province, and who from their technical and scientific training in one or more of the mining schools and laboratories of Europe or the United States, as well as their experience of the well-worked mines of those countries and the laws and regulations concerning them, are eminently capable of creditably filling the appointment.

Secondly—Those Canadian mining engineers who having graduated in the technical schools of the Dominion, and having had an equally careful scientific training, and possibly quite as much actual experience of practical mining as the former class, are technically quite as eligible, and have the undeniably superior claim of nationality.

Thirdly—That outside class of crude and embryo miners, half-speculators, half-prospectors, —wholly loafers—who are usually found vegetating

on the verandahs or at the street corners of the nearest village to where active mining operations are going on; middle class "corner boys" without occupation or visible means of subsistence, except the "finest shows you ever saw," and the tracts of mining lands they have secured the Lord knows how, which they don't develop themselves or let willing labour develop; the parasites who gnaw the life out of legitimate mining in any country; the mining cuckoos who eat the nest-eggs of investors, lock up land and send the sons of the soil to labour and produce in alien countries; citizens who consume and produce not, whose only claim to citizenship is that they are always on the Government side, like the Vicar of Bray, for emoluments' sake; the willing receivers of election promises and distributors of election favours on the stump of their occasional and only activity—without technical or moral qualifications of any kind, for such an important and honourable appointment. This class may, unfortunately for the country, urge the claims of promises given in time of political peril or some other plausible and equally feeble obligation. But an intelligent and powerful community like the mining interest of Quebec, representing as it does the invested capital of many countries—having its organized Mining Association, and its trumpet of the press ever ready with clarion blast to denounce the wrong in the interest of the good "*bonis nocet quisquis pepercerit malis*"—cannot recognize such claims without protest.

Let not the Government be embarrassed in its effort to select the right man by any political interest or bias whatever. Let us aid the minister of the Department in his duty of selecting the right man by pointing out with straight finger not the man but the class. Let the appointment be made after the crucial test of examination papers. Put the candidates through the concentrating process of competitive examination, and the "corner boys" will "pan out'" low grade.

The General Phosphate Corporation.

The REVIEW is fully alive to the fact that its welfare is co-incident with the prosperity of the mining industries of the country. Therefore, both private interest and public spirit combine to impel its management to pursue an editorial policy such as will best conduce to the promotion of the success of every legitimate effort to develop Canada's mineral resources. Animated by this spirit the REVIEW has always exercised tolerance and forbearance towards every enterprise that showed a genuine purpose of conducting practical operations, even though there was abundant reason for criticising its methods. It has pursued this course towards the General Phosphate Corporation, although fully aware of many objectionable features in its organization and management; because the company engaged in active mining work and the REVIEW had every reason to wish the undertakings to be successful. It was only after the results of the efforts of the first year were published to the world, and the events of the second year had become common talk, that the REVIEW mentioned the obvious fact that the enterprise was a hopeless failure.

For daring to say what was in the mouth of everybody who had any familiarity with the affairs of the Corporation, we are denounced in public journals by the irate promoter, and accused of making statements that have "no truth whatever," and of being the organ of "owners of properties who were disappointed in selling to the Corporation." Libel suits are threatened, and the air is blue with denunciations. Since things have come to this pass, we think that the rules of courtesy are no longer binding upon us, and that the time has come when it is right to give to the public a brief outline of the history of the General Phosphate Corporation.

In the year 1889 a "phosphate boom" occurred in London, owing to the advanced price and threatened scarcity of phosphates, and the London market was flooded with offers of Canadian phosphate lands. Soon it was rumoured that "a million pound trust" was to be formed to acquire Canadian lands; and speculators went through the country bonding properties, until a vast amount of territory was locked up and placed under offer in London. Production was suspended on some of these properties that had been working, and the output of Canada fell off 10,000 tons the next year in consequence.

Among the speculators who were attracted by the excitement was the Hon. C. C. Colby, then President of the Canadian Privy Council, who had bonded lands in the Lievres River district. A prospectus of the "Phosphate Trust" was privately circulated in London, having among its directors the name of "Sir Charles Tupper, by special permission of the Dominion Government." By means of the great influence of promoters and vendors a great list of "founders" was obtained, numbering more of the nobility than had ever been grouped together before in a joint stock enterprise. In 1890 the affair was issued to the public under the name of the General Phosphate Corporation.

The Three Rivers Meat Company had meantime made its fiasco, implicating members of the Dominion Government, and possibly this was the prudential reason why the name of Sir Charles Tupper had disappeared from the directorate of the phosphate enterprise. In spite, however, of all this influence the public responded very poorly, and promoters and founders had to come to the rescue to float the concern.

The shareholders were so alarmed by the many criticisms made against the enterprise that the directors, rather than make further calls which would probably be resisted and involve litigation, decided to raise £100,000 by means of debentures, the loan costing them outright at the start the enormous sum of £15,526 14s. 7d.

In the selection of lands we should judge that the Corporation were guided more by the dignity of the proprietors than by the merits of the properties, for out of the three million acres that they say were offered to them they selected 2,660 acres of virgin land only opened up by prospector's shows made with the view of a sale, but belonging mainly to eminent men, none of whom had ever been actively interested in phosphate mining. The Hon. C. C. Colby, Mr. A. P. Peterson, Chief Engineer of the Canadian Pacific Railway, and the Hon. Peter Mitchell were among favored vendors, and with these were associated a Mr. Wm. Macintosh, of Buckingham, and Mr. George Stewart, of Ottawa, the latter owning some lots, chiefly in Bowman above the High Falls, where no productive mining had ever been done, in consequence of the inaccessibility of the region. These lands, which probably did not cost the vendors £10,000, were sold to the public for £98,863 11s. 1d., including expenses of purchase. To operate these lands a manager and contractor in Canada each received a yearly salary of $5,000, while in London the expenses for the first sixteen months, as shown by the report and balance sheet, aggregated some £23,686 17s. 7d., the sum of £3,802 5s. 10d. being debited to trustees' and directors' fees alone. Any one conversant with the Canadian phosphate industry knows that when prices are fairly high a good commercial profit may be made, but that there is no possibility of the great speculative gains that attend the mining of the precious metals. It is therefore clear that any enterprise weighted with such expenditures was doomed from the start, and that we were justified in stating that "its affairs have been grossly mismanaged," and that the statements of the prospectus "were made either without knowledge or with the deliberate intent to mislead the public." We stated also that the "promoters and vendors are the only persons who have obtained any benefit, but as the promoters probably receive their gains mainly in shares, they may not deserve congratulation, and it is only the eminent vendors who have "feathered their nests." These gentlemen received, besides a modicum of cash, the company's notes, secured by mortgage, and their influential connections permitted them to sell these outright in London at a small discount. So they fortunately got out of the operation all right. As a commercial transaction it is doubtless justifiable to sell things for what they will bring, but we cannot help feeling that it is to be regretted that statesmen should use the influence of their high positions to make a profit in such dubious transactions.

The moving spirit and chief promoter of the concern was one Knud Sando, a company promoter whose antecedents and substance are an unknown quantity, ably assisted in securing the titled founders by a peripatetic guinea-pig by the name of "H. Mallaby Deely, Esq., M.A., L.L.M." The London *Financial Critic* makes some very pointed references to this gentleman's career. After referring to the signal failure of

one of his salt trusts, it says: "He went in strongly for director-mongering, undertaking to supply company promoters with high-sounding names for directorates, and for this purpose always kept a large stock of Marquises, Lords, Baronets, M.P.s, etc., in readiness. Hitherto we understood that the formation of a directorate has been to the promoter an exceptionally difficult, not to say delicate operation; for, leaving aside all others, there is one very awkward obstacle that has to be encountered—the promoter or his friends do not happen to be personally acquainted with the gentlemen upon whom they would wish to bring their persuasions to bear, and their desire to include a few titles on their board has been in vain. Mr. Deeley, however, has changed all this, and by his system promoters can have lordly directors supplied them on the same principle as their tradesmen would supply them with butter." The Colonial Finance Corporation, Limited, had some hand in the affair, especially in connection with the North Star mine, and they sent representatives to this side who employed Dr. Francis Wyatt, of New York, to make reports on some of the properties. Mr. Sando says: "We had experts examine the various properties," but of those he names, Dr. Sterry Hunt was at the time an invalid in New York, Mr. Vennor was long since dead, while Dr. Penrose was Assistant State Geologist of Texas. We doubt if Prof. Chapman took the field at that time; so that the expert list is narrowed to Wyatt, Frossard and Obalski.

Now just a few words as to the mining operations. Work was undertaken on three properties. The Murphy lot in Templeton, after yielding 200 to 300 tons, was abandoned. The Ross Mountain, after an enormous expenditure and the placing of machinery in most difficult places before deposits of phosphate were verified, yielded a few hundred tons of high-grade ore and was closed down—a failure. At the High Falls extensive and expensive work was done, for transportation through the long rapids and around the falls enhanced the cost of supplies. Some considerable amount was raised here, but a large quantity was of low grade, and the total cost was vastly above its market value, even before prices fell to their present lamentable rate. The statement that 4,000 tons have been mined is grossly misleading. Doubtless a great amount of rock has been blasted and there is a considerable stock of low-grade phosphate on hand, but at present Canadian phosphate under 75 per cent. is barely merchantable, and we believe that the production of high-grade phosphate up to the date of the last report had not reached 1,000 tons. The expenditure at the mines for the term embraced in the report was £18,507 10s. 6d. Of this it might be fair to allow £6,500 for permanent investment, leaving to working expenses £12,000, against which £3,339 was realised by phosphate sales. To cover the cost of mining it would have been necessary that there should still remain at the mine 3,000 tons of high-grade phosphate, and every miner in the district knows that nothing of the sort was the case. It is safe to say that taking all the expenses of the company into consideration, every ton of phosphate raised has cost nearly ten times what it is worth at present prices.

Among the needless expenses incurred that have helped to swell the accounts, we may mention the sending out of a London solicitor to examine the titles of the lands, when eminent Canadian lawyers, far better versed in the matter, would have done the work for a tithe of the charge: also the employing of surveyors to draw maps of the properties, and the great amount spent in travelling expenses, which included the secretary's honeymoon trip to Canada, ostensibly to instruct the people here how to keep their books, or in their own words, "to arrange for a uniform system of keeping accounts." In fact the whole scale of operations has been carried on in the lordly manner appropriate to such a "Ruby and Sapphire" mine—another scheme which some of these same promoters have since floated in London.

We must note also the item of £7,798 10s. 6d. paid for an option of purchase on the North Star mine, the recovery of which depends upon the successful floating of a great superphosphate scheme which has been hanging fire in London for a year past awaiting a receptive condition of the investing public. It is most desirable that Canada should produce phosphate and manufacture superphosphate, and that our farmers should learn how to use the marvellous means of wealth that nature has placed within their grasp, but it is worse than useless for these enterprises to be floated in so reckless and extravagant a manner that their commercial failure is a foregone conclusion; for by this means a prejudice is created that prevents legitimate operations from being undertaken. The only verdict that can be given from the survey of such schemes is, either that the promoters are woefully and wilfully ignorant of the matters in hand, or else that the schemes are merely put forward for the purpose of unloading burdensome properties, enriching promoters, and providing fattening "husks" for the guinea-pigs.

Now we can have no personal motive in saying these things; in fact all such motives would lead us to be silent in face of these difficulties and disappointments. But we have the good and fair fame of our country at heart, and as public journalists we feel bound to put on record the true causes of the failure of an enterprise which is likely to be a public as well as a private calamity, in that it will weaken confidence both in the minerals in our high hills and the men in our high places.

The Mining Society of Nova Scotia will hold two sessions at Halifax on 17th prox. Papers will be read by H. S. Poole, F.G.S., John E. Hardman, M.E., E. Gilpin, Jr., F.G.S., J. S. McLennan, and J. G. Rutherford. It is proposed to have a dinner in the evening, but if the weather be favorable and the members wish it, this may be changed in favor of an excursion to some neighbouring district, or a trip on the harbor.

EN PASSANT.

Shortly after we last went to press the vote was taken in the Parliament of Nova Scotia on the bill increasing the royalty on coal. It was a strict party vote, although there had been much squirming in caucus, and several members disliked the retroactive character of the bill and believed individually in the contention of the lessees that it was a breach of contract. The reasons for this contention have been published; they are endorsed by opinions from lawyers of the highest standing, Mr. Borden, Q. C., Mr. Henry, Q. C., Mr. Gray, Q. C., and Messrs. Drysdale, Newcombe and McInnes. No opinion to the contrary has been made public, but the bill passed.

If, said the lessees to the Government, you are as confident that you have right as well as power on your side as we are that moral justice is with us, agree to abide by the decision of a legal tribunal. This was a fair offer, but we are ashamed of the Government of Nova Scotia to say that it was not even entertained.

What can Nova Scotia in future expect capitalists to say, when asked to invest in mines in that province, of the security of tenure offered them? Can it be expected they will be satisfied with titles of a similar nature to those that induced their predecessors to walk "into my parlour?" Evidently even the Government of Nova Scotia of to-day does not think so, for at the last moment they added to the bill a clause authorizing the issue of leases at a still higher rate of royalty for a fixed term. Consoling, certainly, to present lessees, as it is tantamount to saying to them, "We do not recognize your leases as giving you the fixity of tenure previous Legislatures supposed they granted you, and you had better take out a new lease and agree now to pay more royalty or you need not be surprised at increasing impositions being from time to time put on you; in short, freeze you out if you are contumacious." Not content with this clause, a prominent member of the Government hinted at forfeiture of the leases if the lessees were troublesome. Most worthy motives.

And a fresh crop of capitalists are expected to swallow such bait and not to apply their experience that men who have once broken faith are likely on little excuse to so do again when needs must. Verily, there is great credulity in this world.

One course, however, does offer them reasonable security. Let them insist on having in their leases a clause leaving to the Supreme Court a settlement in the event of a dispute arising as to the meaning of the leases. To trust to the Government after this experience would be silly indeed.

The Government of Nova Scotia has passed what is known as a Compulsory Arbitration Act for the settlement of disputes between employees and their employers when coal owners and coal owners only. Disputes in other industries were not embraced in the fatherly regard for the

advancement of labour. Nor was the sauce compounded for basting the goose considered suitable for treating the gander. This was nicely illustrated this Spring. When Premier Fielding was sitting as an arbitrator on a dispute over the discharge of one man at Spring Hill mines, his Government positively declined to submit to arbitration the dispute they had raised with lessees over their proposition to increase the royalty on coal at will, contrary to what the lessees are advised is both the spirit and letter of their contract with the Crown.

A special meeting of the Gold Miner's Association was held on Thursday, the 12th of May, to consider the question of amalgamation with the Mining Society of Nova Scotia. After discussion it was voted to authorize the council to amalgamate the Association with the Society, and to turn over to the Society the assets, debts and membership of the Association. The Mining Society will doubtless ratify this action at the quarterly meeting, to be held June 17th at Halifax, and the Gold Miner's Association, which, for more than four years, has done so much good for the gold industry, will cease to exist as a separate association, but its field of usefulness will, if anything, be enlarged and strengthened by its union with the Society. At the meeting it was announced that the geological maps of the Province were to be published on the larger scale, and a vote of thanks was given to Mr. B. T. A. Bell, of the REVIEW, for his efforts in that behalf, and to several members of Parliament who have aided in this good work.

In his annual report, Mr. E. Gilpin, Inspector of Mines, estimates the mineral production of Nova Scotia during 1891 to have been as follows: Gold, 23,391 ounces, as against 24,358 ounces in 1890, or a decrease of 967 ounces; iron ore, 57,311 against 55,191 in 1890, an increase of 2,120 tons; coal 2,044,784 tons, as against 1,984,001 tons in 1890, or an increase of 60,783 tons; coke made 34,148 tons, against 36,738 tons in 1890, being a decreased production of 2,590 tons; gypsum shows an increase of 15,931 tons, the returns giving an output of 161,934 tons, as against 146,003 in 1890; the other products include: Manganese ore, 41 tons; grindstones, 19,800; moulding sand, 230 tons; antimony, 10 tons; limestone, 18,000 tons; copper ore, 900 tons. From the published returns of the coal sales we find that 1,849,945 tons were exported as against 1,786,111 during the previous year. The home sales were 639,737 tons, compared with 601,956 tons in 1890. The Province of Quebec took 775,286 tons against 751,931 tons in 1890; while the sales to the United States were 2,586 tons round, 58 tons run of mine, and 22,788 slack coal, in all 25,431 tons, as compared with 50,854 tons for the year previous. Mr. Gilpin reports the sales to Newfoundland, New Brunswick and Prince Edward Island as showing but little difference from the returns given in 1890.

Arrangements are nearly complete for the ensuing Quarterly General Meeting of the General Mining Association of Quebec, at Black Lake. Visiting members will leave Sherbrooke by special train on the morning of the 14th. After spending some time inspecting the asbestos mines at Thetford, all will return to Black Lake, where the meeting will be held in the Club House. Mr. J. Burley Smith, M.E., Glenalmond, will read a paper on "The Labor Question in its Relation to Canadian Mining," to be followed by one from Mr. L. A. Klein, on "The Present Status of the Asbestos Industry." Members will be the guests of the Asbestos Club, by whom they will be entertained to supper after the meeting. A pleasant outing and an instructive meeting should induce a strong turn out of members.

Our London letter, under date of 30th, reports the phosphate market as follows:—

"The market for phosphate is exceedingly bad, but Canadian 80% can be sold for Hamburg, at 10½d., and possibly up to 11d., and sellers are asking 1s. and in time I think they will get it. Florida 75%, after touching 8½d. is now 9d. and 9½d. asked. Bull River has at last tumbled down, and a contract was made yesterday at 7¼d. Grand Somme cannot be quoted above 10½d. for 70% and 11½d. for 75% London. Under these circumstances it would hardly seem advisable to sell at present, as so many mines having stopped, the market is likely to improve. I hear the Corporation is to be sued on all hands and is likely to be soon wound up."

Later reports indicate an improvement in the market with a slight advance in prices.

In another place we reproduce (from a photograph taken by one of his Toronto victims) a portrait of Charles Miles De Tracey Dobson, the subject of our article in last issue. In a thoroughly characteristic letter to the Ottawa *Free Press*, Dobson denies that he ever carried credentials from John Taylor & Sons. We never said he did. The copies he presented to us in 1886 were *forgeries*. It is unnecessary to deal with this blatant effusion further than to remark that when he takes his threatened action for criminal libel we will be fully prepared to incriminate him on every point of our indictment.

In his summary of the proceedings and work of the Geological Survey of Canada during last year, Dr. Selwyn has something to say of the injury and loss too frequently created in this country by the mining quack. Unfortunately, the opinions of these self-styled "experts" and "practical miners" are too readily accepted and acted upon, often in preference to a member of the Survey who is thoroughly acquainted with the geological structure of the district in which the information is desired. "These 'expert' and 'practical' opinions," says Dr. Selwyn, "rarely prove correct, and their first cost, often considerable, is by no means the greatest. Not a year passes unmarked by such cases, and the past season is no exception. The boring for gas at Stewarton in 1889; for water at Morden in 1890; for gas at Belleville in 1891; and for oil at Pincher Creek in the past summer, are some of the instances of such useless expenditures, all of which might have been saved had the advice of the department been sought and followed." He might have added the losses sustained by the Ahn Reduction Works blunder at Sudbury; Lucius J. Boyd's fabulous asbestos discoveries at Garthby; and the oil finds of that master-quack and imposter, the smooth-tongued and wily Dobson. The history of mining in Canada is pregnant with quacks and their vagaries. Dr. Selwyn's narrative of the Pincher Creek petroleum boom may be quoted in his own words:

"I found considerable excitement existed in the village, in fact, a decided boom in petroleum claims, and that a company had been formed to put down a boring, the site selected for the experiment being on sec. 21, township 3, range 29, some 18 miles south, a little east of Pincher Creek Village. On Monday, the 20th of July, I proceeded to the locality named, accompanied by several gentlemen interested in the work. The country traversed is fine farming land, a richly grassed undulating prairie well watered by numerous small tributaries of Pincher Creek and the Waterton River, all of which eventually find their way to the Saskatchewan. The site of the proposed boring was on a small flat on the left bank of one of the tributaries of Waterton River. A gang of men were at work erecting a derrick and preparing to put an engine and boiler, already on the ground, in place. The evening of the 20th of July and the whole of the following day was devoted to an examination of the rocks that were exposed in the creek both below and above the site selected for boring. They were ordinary varieties of sandstone and sandy shales of the Cretaceous, with irregular dips from 15° to to 20°. The last exposure of these rocks up the creek was about three miles and a quarter, then, for about three miles further, there were no exposures up to where the creek emerges from a rocky gorge, all along which there are good exposures of hard, flinty red, green and grey shales and sandstone, often gritty and quartzose and dipping to south south-west at 25° to 30°. These are the Cambrian rocks which here form the base of the eastern spurs and ridges of the Rocky Mountains. It was stated that both at this gorge and at several places in pools on the prairie to the eastward petroleum had been seen, but no one at the boring camp could show me any of these places. The whole country for miles around and up into the entrance of the South Kootenay Pass, nine miles to the south, was marked off with the stakes of the oil claims. On inquiry, I was informed that an 'expert' named Baring had been there and had expressed a favourable opinion as to boring where operations were being commenced. I was unable to learn any other reason for fixing on the site. The note I made under date 21st of July reads: 'There is nothing whatever to indicate the existence of petroleum in this vicinity. It seems highly improbable that it should be found here, though, of course, not impossible.' I subsequently heard that a copious flow of water had been struck and the boring abandoned. The cost of this very absurd and useless operation must have been considerable."

The moral of all this is that extra care and precaution should be taken by capitalists to ascertain the qualifications, experience and ability of those engineers or experts upon whose statements or reports they may be called upon to invest their money in mining enterprise.

In all cases an investor, to whatever kind of undertaking he inclines, must largely rely on the judgment of others regarding the value and probable prospects of any particular property; but if this be so in regard to almost every kind of industrial undertaking, still more is it so in regard to mining enterprise, because not only are the properties, as a rule, situated a long way off, but the whole details of management are of so intricate and technical a nature that entire reliance must be placed on those who are, or who profess to be, experts in these matters. Those who are interested in mining and believe as we do, that it is a legitimate and often enormously profitable means of employing money, should insist that any laxity in connection with the all-important point of thorough initial investigation of mining properties will be held to entail grave responsibilities on the part of those who profess to speak authoritatively on

that of which they barely know little or nothing. The history of many Canadian mining enterprises points out in no unmistakable manner how lamentable has been the loss of capital for lack of that competent preliminary inspection and investigation which should be made into the capabilities of every mining property before the public are invited to invest their capital.

Mr. Sando, the promoter of the General Phosphate Corporation, is exceeding wroth at our outspoken criticism and *expose* of the affairs of his company, and with characteristic fanfare and bluster threatens an action for malicious libel. Mr. Sando has many bees in his bonnet just now, but we seriously doubt the sincerity of his intention to extend the collection by the addition of a first-class hornet's nest. People in glass houses don't throw bricks.

The last act in the White's Asbestos Company swindle was played out at Montreal the other day when the so-called asbestos lands at Garthby were unreservedly put up at public auction and did not receive a bidder. In the light of the unenviable record of the company and its ignominious collapse comment is unnecessary. It may, however, be interesting news to Mr. Lucius Boyd, the engineer who sent home such glowing reports of their value, and mainly on whose exaggerations—to put it mildly—the lands were unloaded at a high figure on an unsuspecting public.

Last month a reference was made to the death of a miner resulting from the alleged fumes of a roburite cartridge. The matter has since been brought up in the House of Commons when the Home Secretary stated that the facts of the case had been brought to his notice. Although the jury decided that the death of the deceased man was due to the poisonous fumes of a roburite shot, yet there was at the inquest a difference of medical opinion on the subject, and he had since had other competent opinions not in accordance with the verdict. The inspector of the district informed him that the precautions observed on the occasion in question, both in respect of the time which elapsed before the workman returned to the working place, and in respect of the air current which passed through the working place, were in conformity with the recommendations of a skilled commission in Durham which enquired into the possibility of danger arising from the use of roburite as an explosive in mines. Under these circumstances he did not think that he ought to interfere under the Coal Mines Regulation Act to prevent the use of an explosive which was largely used and which had the advantage of being flameless.

A writer in the *Adelaide Observer* speaks hopefully of the future of gem mining in South Australia. That gems of various kinds, he says, from the diamond to the garnet, exist in that colony has long been known, but probably only a few persons are aware how great a variety has been met with. Diamonds were first found at Echunga about 36 years ago, and it has been computed that over 100 were secured on the diggings. No doubt, four or five times as many were thrown away by the diggers, owing to their ignorance of the nature of the gems. Most of them were small, and although two were worth respectively £20 and £50, the average value would probably not exceed 30s. each. Some years ago the Government employed Mr. Bean, who had recently returned from the African diamond mines, to visit Echunga and write a report on the prospects of finding the precious stones there in paying quantities. Mr. Bean's report was moderately in favour of diamonds being found, but he was not very successful in meeting with any deposits of the gems. It has been stated that diamonds have also been met with in the Far North, and it was said some years ago that one worth 70 guineas was picked up over 300 miles from Adelaide. Where they have been found there is a probability of more being met with, and a few hundred pounds expended in digging for diamonds at Echunga might prove to be money profitably spent. After referring to the article upon "The Diamond Mines of India," from the pen of Mr. A. Mervyn Smith, which appeared in these columns towards the close of last year, the writer points out that a great similarity exists between the formation in which gems are found in India, as described by Mr. Smith, and that of the large watercourses beyond Port Augusta. The writer has often thought from the appearance of the creeks, such as the Frome, the Arcarola, the Brachina, &c., and of the country through which they pass, that a proper search in their beds would probably be rewarded by valuable discoveries. If only 1 carat weight of diamonds is reckoned payable in India, we should persevere in the search, even though at first no more than this should reward our efforts. At the same time the different labour conditions in the colony would require 3 or 4 carats to make the work payable here. But let the fact be established that diamonds are to be found, it will be worth while to prosecute the search. Nor should the prospecting for gems be confined to the Far North. The North Para River, the Onkaparinga, the Torrens, the Hindmarsh, and the Norman are all worth trying. The Para is noted for the brilliance of the white topazes it contains, the Onkaparinga and the Torrens have yielded small spinnelles, zircons, and "gem sand" is found near the mouth of the two southern streams. Long before the discovery of the "rubies" in the Far North, the late Mr. John McKinley brought down from one of his exploring expeditions similar stones of beautiful colour and lustre, and longer ago still old Mr. Menge made a fine collection of gems, which he obtained chiefly in the Barossa district. Beryls are known to be plentiful in the neighbourhood of Mount Crawford, and opals are found there and at Angaston. Many years ago Mr. S. Vale, who obtained the prize at the Prince's Exhibition in 1867 for his geological collection, found a splendid Oriental topaz in the Port Lincoln district. The Episcopal Pastoral Staff, which was presented to the late Bishop Short, some five and twenty years ago, contained a large number and variety of gems, said to have been all found in South Australia. All these facts go to show that there are precious stones in the colony, and that all that is required to be done is to set to work with a will to unearth them. A few months ago a storekeeper at Farina found a magnificent bluestone in the Far North. It was broken into several pieces, the largest being about the size of a pigeon's egg. He had them all well cut, and they would have passed for sapphires from their splendid colour and lustre, but they were not the true corundum, though quite equal in appearance.

CORRESPONDENCE.

Our National Museum.

SIR,—Mining, and the various branches of industry connected with it, are of the first importance to the trade and national advancement of any country.

A national museum is the index to the mineral wealth and resources of the country. It ought to contain specimens of both scientific and economic value found in the country, and classified under the various branches of the natural sciences, and also under the classification of trade conditions or industrisl uses.

Our Canadian Museum at Ottawa falls short of now filling the requirements of the ever-increasing progress of the mining industry in Canada, and valuable collections made in all the departments, both scientific and industrial, are crowded and hidden for want of proper space and light to show the exhibits.

The building is not now sufficient to exhibit the Canadian specimens it contains, and was not built for a museum, and is not suited for that use. The danger from fire is also another serious point against its use as the National Museum of Canada.

As an educational institution its value is greatly lessened on account of there being no room to exhibit foreign ores and minerals, which have not, so far, been discovered in Canada, but which, from the similarity in the geology of a foreign locality and that of parts of Canada, we may reasonably expect, with industry and care, to find similar Canadian ores and minerals. This is a question of vast importance to the mining interests of the country, and for want of house room in this somewhat thinly populated country, or possibly of too much so-called economy on the part of the Government, the mining interests are not aided in the discovery of new Canadian ores or minerals.

The amounts expended by both the Federal and the several Local Governments on scientific, educational, and experimental agriculture and forestry, is largely in excess, and out of all proportion to that devoted to the advancement of the mining interests of the country, and hence the call for the erection of a suitable structure for a National Museum is a fair demand, warranted by the importance of the mining industry and the present necessities of the case.

We desire also to endorse the request of Dr. A. R. C. Selwyn, the Director of the Survey, to have the museum made still more useful by having it opened to the public on Sunday, as is done in similar institutions in Great Britain and the Colonies. If "the works of nature are the works of God," it cannot be very wrong to study and admire these special works when arranged in a National Museum so as to illustrate the orderly evolution of the world and life, from the early forms of rock and life, through the various epochs of development, to that in which we find them to-day. The museum ought to be opened on Sunday for the better education of the working classes who cannot spare time from their every-day work to visit it during the week.

Until such time as we have a building in the Capital of the Dominion which is worthy of the name of a National Museum it is premature for local sections to advocate the establishment of a school of mines in isolated sections.

The attention of Parliament is again called to the pressing necessities for the erection of a suitable building for the national collections of Natural History and of the Geological Survey. K. S.

OTTAWA, 10th May, 1892.

C. M. Dobson.

SIR,—Allow me, as a constant reader of your valuable paper, to express my approbation of your course in the April issue of the REVIEW in giving the mining public warning against Mr. C. M. Dobson, whom that gullible sheet, the Halifax *Critic*, had so cheerfully held up to be admired and worshipped by its readers. More than a year ago I was privately informed of the unreliability of Mr. Dobson, and it is now gratifying to learn that that information is accessible to the general public. The *Critic* for some years has been a laughing stock for the mining public in publishing just such trash as this endorsement of Mr. Dobson. Yours, etc.,

HALIFAX, 25th May, 1892. STORMONT.

Portland Cement.

SIR,—Will you kindly inform me through the medium of your paper:—

(1.) What are the ingredients of Portland cement, and (briefly) how prepared?

(2.) Is water lime calcined before being ground? and wherein does it differ from common carbonate of calcium?

(3.) Is there any market for best marl? If you have a column of "replies to inquirers," I will be glad to have reply through it. There are several lakes and marshes on line of junction of sedimentary and archean rocks worth inspecting.

Yours, etc., T.F.

LITTLE CURRENT P. O., ONT.

[Portland cement is made under two processes, called the dry and wet. The ingredients used are clay and chalk, or stone and clay. In the latter, and under the dry process, the stone is burnt into lime, and the lime is mixed with the clay in a slurry. This is carried into dry pans over the kilns, and the stuff is then burnt into slag. It is then passed through stones or crushing machinery, and ground very fine. Some manufacturers grind the limestone and mix it into bricks with the clay, and burn it in that way, afterwards grinding it. In the composition of clay and chalk, which is the cheaper way of manufacturing cement, they are simply run into a slurry. Marl has also been found to be a good substitute for chalk, and where large deposits of such are found, if in a convenient location for shipping, is valuable, providing good river clay, or brick clay can be found in close proximity.

The analysis of cement is about as follows:—

	Per cent.
Lime CaO	63.60
Silica SiO	22.60
Alumina Al_2, O_3	6.72
Oxide of iron $Fe_2 O_3$	1.69
Magnesia MgO	0.97
Potash $K_2(O)$	1.62
Soda $Na_2(O)$	——
Sulphate of lime $CaSO_4$	——
Water H_2O	——
Sulphuric acid	1.30
Carbonic acid	1.50
	100.00

—EDITOR.]

Notes From New Brunswick.

SIR,—I certainly owe you an apology for not having written you some items before now from New Brunswick, but was waiting for something tangible to present, also in the hope that our Local Government would have made some additions to, or some amendments to, the recent Mining Act passed by them, with a view to simplifying the same, but I regret to say, nothing has been done to that end.

While I and many others have a firm belief that there are mining districts in N. B. worthy of development, I am also firmly of the opinion that capitalists cannot be induced to expend any very large amount of money in New Brunswick mining localities while the industry is handicapped by useless and heavy royalties. If New Brunswick had positive mining grounds, yielding gold, silver, coal, iron., etc., in abundance, then the infliction of such royalties as are asked now would not be so bad, but when we are trying to develop the resources of the Province, and prove by the expenditure of time and capital that there are workable and profitable mines, it would surely be but wisdom on the part of the Government to exempt all royalties for a term of years at least. This is the view taken by practical mining men, who are talked to on the matter, and are sincere in their desire to see the mining interests of the Province developed. Meantime, I learn from good authority that a couple of the best areas in St. Stephen have been bonded for some English capitalists who propose to start work of test and development at once on the Hall-Carroll nickel properties. The matter is in good hands, and if the nickel appears in as good quantities as stated, and as numerous assays of it show it to contain, we may look for a very tangible and profitable boom in this locality. The ore is abundant, and yields copper, silver, and in some instances traces of gold and nickel. The ore when placed side by side with the Sudbury ore can hardly be told apart. We trust this venture will be attended with success, and we shall keep you informed as to its progress from time to time.

The Alma Copper Company has succeeded in forming a development syndicate or company, and propose to open up the copper veins and deposits on the Bay shore in the Alma district in Albert County. The prospects are exceedingly good, so it is stated, there being a fair body of ore, and of a good grade. The company intend working cautiously and economically, and under the direction of a Capt. O. V. Brain, who, it is said, is a miner of some considerable experience. The New Brunswick Mineral Development Company of St. John, N. B., of which J. De Wolfe Spurr is President, and E. Wetmore Merritt, Secretary-Treasurer, are the parties who are prominent in the formation of this company. Their efforts will be watched with considerable interest, and it is to be hoped they may prove thoroughly successful.

I have not heard anything recently of the development at Woodstock of the silver mine on which considerable money has been spent, but presume the owners intend pushing forward further explorations. The Woodstock people are to be congratulated on the fact of their faith in their enterprise, and their willingness to put their money into it, no matter what the final result may be.

Rumour states that an important gold-bearing ledge has been discovered in a certain section of the Province, and that parties who have spent considerable money in prospecting the same will shortly take up such necessary areas as they need, and propose putting in sufficient machinery to give same a thorough test. We trust the rumour is correct, and would be pleased to know that gold has been found in N. B. in paying quantities.

Prospecting and development for coal on the Oromocto river, a branch of the St. John, is going on, so we understand, and the parties behind the enterprise seem to think their efforts will be crowned with success. If any special features occur in connection with the same, will try and keep you posted on the same.

The Manganese mines near Sussex and vicinity are idle at present writing. It is stated that the Pope Manganese Company of Boston will resume operations at Markhamville during the coming summer. The Jordan Mountain Manganese mine was visited by a Mr. Dobson, M. E.—whom tne REVIEW scores so unmercifully in the April number—with a view to its purchase by Chicago capitalists. If the parties who were instrumental in bringing Mr. Dobson here and to Nova Scotia—at, it is said, a very great expense—have been misled, it is to be deplored, as a few such cases as this will serve to do more injury to legitimate mining deals than a little.

It is said Mr. Dobson also figured as a Railway or C.E., having been employed by St. John parties to look into the merits of a proposed railway contract in Cape Breton. Just how correct this is cannot be stated, but with the reputation the REVIEW gives him, the less railway contractors have to do with him the better, I should judge.

Nothing definite is known of the gold and silver veins at or near Bathurst, which it is said were being prospected last season with a view to development and sale.

The plumbago mine of Messrs. Best and McLaughlin, near the Cantilever bridge in St. John, is being steadily worked, and a fair sale of product is being made. The deposit is not of the highest grade, but sufficiently pure to meet with a fair sale at reasonable prices.

The opening up and putting on the market the waters of the Hamlock Mineral Spring, near Petitcodiac, N. B., while not strictly of a mining nature, is worthy of note. A strong local company has been formed, machinery put in, and the manufacture of the water into ginger ale, lemonades, etc., commenced. The natural water is also charged with carbonic acid gas, and is being rapidly sold as a rival to the famous Appolinaris water. The company is meeting with grand success so far, and feel highly encouraged in their venture.

Yours, etc.,

CRYSTAL.

Fredericton, May 3, 1892.

The Gay's River Conglomerates.

SIR,—Seeing a letter in your February number by Robt. R. McLeod concerning the Gay's River conglomerates, Nova Scotia, I, as an old miner of 14 years' experience in the Ballarat and surrounding district of the alluvial deposits there, fully endorse all that Mr. McLeod says in his letter regarding them. From the description which he gives of the conglomerates, or the alluvial deposits, as they are called in Australia, I have not the least doubt, from what he says has been got already, that if the old bed was found I have no doubt that good payable gold would be got. It seems from what he says that the alluvial wash is very wide, but the main channel may not have been found yet. It is very common in the Ballarat district to have what is called "flat reefs"; that is, ground of considerable extent more or less, a little higher than the main channel, with wash all over it, carrying gold more or less, sometimes payable and sometimes not; but we always make for the main channel. I remember working in a mine 200 feet deep, about ten miles from Ballarat. The shaft was sunk about 250 feet from the old river bed, as we found out afterwards; we struck a flat reef with plenty of wash on it, containing a little gold; we drifted away, always at every shift expecting to strike the "gutter," as the old channel is called there, but we had to drift nearly 250 feet before we struck it, and, mind you, that was not in the main lead, but only a feeder running into it, so you can imagine what a flat reef can be on a main lead. He speaks of sinking through a wash a certain distance and then coming to a bed of sand; I like it all the better for that: that is what is called a false bottom. "A false bottom is composed of sand and of other kinds of deposits." We always reckon *that* a good sign in sinking for gold; sometimes there is a little gold in the wash above the false bottom, and sometimes not. That bed of sand changes the wash entirely. If the wash above the sand had continued to the bed rock without the sand intervening, I would have very little hope of it carrying much gold, but according to his letter, there is an entire change of wash below the sand, and that makes me very hopeful of payable gold being got. It shows there has been a regular flow in the old bed, and if any good gold bearing quartz reefs cross it, they are bound to throw gold more or less; also feeders coming into it help it wonderfully, and you can always make sure of getting good gold a little below the junction. If, by publishing this letter, you think it will do any good towards developing the alluvial deposits of Nova Scotia, I hope you will do so, and oblige,

Yours, etc.,

WILLIAM TODD.

ALMONTE, ONT., April 29, 1892.

Notes from Illecillewaet, B.C.

SIR,—After the long winter's rest this district is beginning to show lively signs of waking up for the summer's work. It was fondly hoped from the warm weather experienced in March last that an early summer would prevail, but these hopes were dispelled by a heavy fall of snow in the end of the month; and a long spell of cool weather, with the absence of the "Chinook" winds, has left a large amount of snow still on hand, and low down on the mountains. Locomotion is both difficult and dangerous over the low divides, and the danger of snow slides, or avalanches, with the softness of the snow on the surface, prevents any but the most daring from trying to cross the mountains. A few days of warm wind and soft rain would make a magical clearance now. So much for the weather prospects.

Mining prospects for the year look very healthy, and it seems as if some parts of the district were going to get good testing. Development work is going to be done in a thorough manner on many of the claims as soon as they can be got at to get stores and tools in. As soon as the trails are passable packing in on horses will commence. In the Illecillewaet Valley several claims are waiting for the snow to leave in order to commence work. The Lanark has been working steadily all the winter, and the output this summer will be a more convincing proof of our great resources in silver and lead than volumes of talk and gallons of ink. The Selkirk Mining Co. intend erecting an aerial tramway from the river up to the mine, and experienced engineers are on the way with the plant. This will be the first aerial tramway erected in the district, and much interest is naturally excited to ascertain the amount of success that will attend it. If successful, as there is every reason to hope that it will be, it will be the forerunner of many more.

Aerial tramways and electricity will be the great factors in realising the wealth of this wonderfully wealthy region. The time is within a measurable distance when the valleys of the Selkirks shall glow with the beams of the electric light, and every necessary work that can be done in the mines will be accomplished through that wonderful and marvellous agency. We have unlimited water-power, sufficient for any number of dynamos, and the force needed can be conveyed to any part of the mountains by wires. Capital judiciously expended, economic and efficient management and the latest and best improvements in mining machinery, driven by electrical power, will place British Columbia amongst the foremost wealth-producing countries in the world.

The B.C. Government have voted some $29,000 for trails in the various districts, and this ought to do a large amount of work and will be of the greatest benefit to the country at large. We have two great excitements at present amongst the mines and mining camps: the Slocan and Kaslo camps, near Ainsworth, South-west Kootenay, and Fish Creek, or River, in West Kootenay. As I am not at present interested in South-west Kootenay we will speak of our own excitement—Fish Creek. That there is a wonderful surface-showing of galena in some of the claims, there is no doubt; and about a dozen claims will have a good and thorough testing this summer. I will mention some of them: the Edinburgh, Elizabeth and Scotia, owned by Messrs. Ryckman, Scott & Co.; the Annie and the Agnes, owned by the Golden Smelter Co.; the Heronback, the Alberta, the King Solomon, the Virginia, the Link, the Stockholm, the Avonport, the Kathleen, the Blarney—all these will be developed more or less this summer. As soon as horses can get in there will be great activity, and many important discoveries will be made. Many men will be out prospecting, and there is an enormous extent of splendid looking country for them to roam around in, and many more claims will be unearthed.

Now about town news. The Professor who was here last summer is back again, and received a hearty welcome from all the boys. There is a Committee of Ways and Means formed to promote the interests of the camp, and they mean business every time. Among the various items of work they have initiated, I may mention, first, they have petitioned the Lieut.-Governor and Council of British Columbia for a complete survey of the country between the C.P.R. and the Kootenay Lake mining camps; petitioned the C.P.R. authorities for a flag station at Flat Creek to facilitate intercourse with Fish Creek; propose running a newspaper for the district, and so on. We have now every description of goods at

reasonable prices through the business enterprise of Mr. D. Lamey, excellent hotels, unsurpassed scenery, and excitement enough for one of Rider Haggard's novels; bears plenty and lively—so Illecillewaet commences the campaign of 1892 in great style. More in my next.

E. A. WATSON.

ILLECILLEWAET, 12th May, 1892.

The Pictou Charcoal Iron Works.

SIR,—In reply to your favour of the 4th instant, I take pleasure in giving you the following information in regard to the charcoal iron furnace plant here at Bridgeville, now under construction.

Our property consists at present of:

1st. About 5,000 acres of heavy old-growth hardwood land, besides the wood bought off an additional thousand acres of land in our vicinity.

2nd. Mining rights on Grant's farm, at our very door, and about 400 acres of other land, only a few miles distant, not liable to any Government royalty; and the right of search for iron ores on five square miles of land at Springville, on five square miles at Sunny Brae, and on five square miles at Blanchard, on all of which places good ore is being found.

3rd. The limestone deposits on Grant's and McDonald's farms at Bridgeville and McLean's at Springville.

4th. The furnace grounds at Bridgeville, consisting of 11½ acres of land on Grant's farm, where the plant now is being erected, while we have completed about half a mile of railway track connecting our works with the New Glasgow Iron, Coal and Railway Company's road (running from Eureka Junction on the Intercolonial up through the East River Valley). From this track we have also graded road beds up to the stack house and coal sheds, through which buildings separate tracks will be laid.

As regards the buildings here we have long since finished our offices (28'x32', with a 9'x16' annex), which contains, besides the office rooms, a drawing and construction room and a chemical laboratory; our carpenter and blacksmith shops (25'x50'), and a stable and tool house. We have also now nearly completed the engine house (35'x70'), the coal sheds, the stack house and the casting house, the former of which is 40'x70'x21' parts, with a capacity of 10,000 bushels of charcoal, and the latter 130'x52'x14' parts, with lantern 10'x4' running the whole length of casting house. The workshops and furnace buildings are to be covered, roof and sides, with corrugated iron, which has already arrived and will be put on in a few days. The hoist tower, which also will be covered with iron, is to be 70 feet high, with double elevators; and the boiler house (20'x32') will have iron frame and iron roofing.

The working plant proper, now under erection, will be of the following description:

The furnace stack, 50 feet high and 11 feet bosh, with crinoline strapping and red brick "shell," supported by six iron columns, and having a wrought iron mantle and water cooling jacket and six braze tuyer and water blocks; the tap provided with a Weimer friction winch and gas-seal; the down corners 36" clear; bustle and blow pipe 15" diameter, with butterfly valve.

The slat blast, a Cooper-"Durham" cast iron stove, with 30 V-pipes, 14'x8", cut in two and reversed, being arranged in two divisions, placed side by side and provided with two combustion chambers, one at the inlet of the cold blast and the other where the now heated blast leaves the stove. This arrangement, made by the writer at the Katahdin Iron Works, Me. (from where this hot blast is now being moved to this place), proved there to be of great economic value, as the temperature of the blast can easily be maintained at a high degree (800° to 900° F.) with a very small amount of fuel (gas).

The boilers, which are nearly completed, will be four in number (30'x36") made of best Dalzel's $\frac{5}{16}$" steel plate, and will be built in sets of two, with separate iron draft stacks and independent steam and water connections, so as to be worked separately if desired, each set being sufficient to operate the entire plant. The fuel for the boilers as well as for the hot blast will, of course, be the waste gases from the blast furnace, and both of them are provided with gas burners of special design, with combustion chambers so arranged as to cause a quick ignition and complete combustion.

The blowing engine has two horizontal blowing cylinders of 5' diameter and 5' stroke, and are the same as have been in use at Katahdin.

The elevator machines, with two of Wood & Co.'s "safety cages," as well as the limestone breaker—a "Foster Crusher-Pulverizer"—will be run by belts from a special steam engine of about 5 h.p.

For the handling and weighing of the stock we will use the Weimer patent charging steel barrows, and the Richle's furnace charging scales and pig metal scales.

The water supply has been provided for by building a 25' high dam on the millbrook (about 800' from the furnaces) and from where two 3" wooden pipes will be laid, besides which a good-sized reservoir is being made about 150' above the furnace level, to catch the spring water which comes out from the hills above the furnace site, and which will thus give us a pressure of about 65 lbs. at the furnace.

Provisions are also made for washing, roasting and screening the ore as it comes out from the tunnels on the Grant farm, a few hundred feet only from the furnace.

Three tunnels are at present driven here, all showing and yielding a fine quality of brown hematite, besides which the McLean limestone quarry at Springville (three miles distant) has been opened up and a couple of hundred tons of the stone delivered to us for furnace use. We are also burning part of the stone quarried for mason work and find it to be of a superior (very strong) quality.

For the carbonization of the wood we have begun erecting brick kilns, of which 16 to 20 will be built this summer. These will vary in size and shape, according to the locality and circumstances, those here at the works being of the round type, with a capacity of 50 cords for kiln (equal to 1,100 cords, or 450,000 bushels of charcoal per annum); and those to be built in the woods of smaller size and of the Plattburg (conical) type. Most of our wood will be burnt in the woods, from where we will haul the charcoal instead of bringing all the wood to the works for carbonization, thus making a considerable saving in freight.

As most of our building materials are here or on the way and we intend rushing work, we are in hopes to be making iron here before many weeks at the rate of 15 tons per day at first, which means a consumption of about 10,000 tons of ore and half a million bushels of charcoal and 13,000 cords of hardwood per annum.

Yours, etc.

ERNST A. SJOSTEDT.

BRIDGEVILLE, N.S., 25th May, 1892.

LEGAL.

Jane Sword vs. The Sydney and Louisburg Coal and Railway Company, Limited.

This is an action in the Supreme Court of Canada, brought by the plaintiff, widow of the late William Sword, to recover dower. The land in respect of which dower is claimed is situated in the Sydney Harbour, Cape Breton. This water lot was granted to Wm. Sword on October 22nd, 1867, the grant being made after the passing of the B. N. A. Act, which became law on March 29th, 1867.

Wm. Sword conveyed the water lot in question to the Glasgow and Cape Breton (Nova Scotia) Coal and Railway Co. (limited) by deed dated June 6th, 1871, and two days subsequently to the date of this deed he (Wm. Sword) died.

On January 10th, 1881, the Cape Breton Co., then in liquidation, made a conveyance to the defendant's company purporting to convey the land in question.

On April 14th, 1881, an Act was passed by the Nova Scotia Legislature incorporating the defendants' company, as follows:

"The purchase by and conveyance to the Sydney and Louisburg Coal and Railway Company, made on the 10th day of January, 1881, of the coal mining leases and real and personal estate of the said Cape Breton Company, limited (including the coal mining leases and real and personal estate of the several companies aforesaid, namely: The Lorway Coal Company, Cape Breton; the Glasgow and Cape Breton, N.S., Coal and Railway Company, limited, and the Schooner Pond Coal Company, limited), are hereby absolutely ratified and confirmed, and the title to said leases and said real and personal estate, and to the line of railway hitherto operated by the said Cape Breton Company, limited, and the lands whereon the same is situated is vested in said Sydney and Louisburg Coal and Railway Company, limited, reserving to any person or persons or body corporate the right to compensation only for any interest in, or lien on, said leases, real or personal estate at the time of such purchase and conveyance."

At the trial it was admitted that since the date of the deed from Wm. Sword to the Glasgow and Cape Breton, Nova Scotia, Coal and Railway Company, limited, of the locus, very valuable wharves have been erected thereon by said company and the defendant company without any claim being made by the plaintiffs.

The plaintiff at the trial in support of her claim put in evidence the grant from the Crown to Wm. Sword, the deed from Wm. Sword to the Glasgow and Cape Breton, Nova Scotia, Coal and Railway Company, limited, the deed from the Cape Breton Company, limited, and Chapter 73 of the Acts of the Province of Nova Scotia for the year 1881; all above referred to.

The action was tried before the Hon. James McDonald, Chief Justice, without a jury, and a verdict was found in favour of the plaintiff. The defendant company appealed from this judgment to the Supreme Court of Nova Scotia in banco, and the appeal was heard before the Hon. Mr. Justice Ritchie, the Hon. Mr. Justice Townshend and the Hon. Mr. Justice Meagher, and judgment was given, Mr. Justice Ritchie dissenting, dismissing the defendant company's appeal, and from this judgment the defendant company now appeals to the Supreme Court of Canada.

The defendant company contends that no title passed to Wm. Sword by the grant to him from the Lieutenant-Governor of Nova Scotia, the water lot in question being at that time vested in the Queen, represented by the Government of Canada, and that the grant could not operate to dissesse the Crown so represented, and that therefore there is no estate out of which the plaintiff can claim dower. The only answer that has been made to this contention is that the defendant company is estopped from setting up this contention because the defendant company acquired their title by or through the plaintiff's husband. In answer to this it is submitted:

(a) That it has not been proved as a fact that the defendant company claim through Wm. Sword; the deed to the defendant company is from the Cape Breton Company, limited, and there is no evidence that the company claimed the water lot in question through the Glasgow and Cape Breton, Nova Scotia, Coal and Railway Company, limited.

(b) That the taking of a deed does not estop the grantee from denying the title of the grantor, or his widow's right to dower.

(c) That an estoppel cannot arise when the party claiming to avail himself of the estoppel himself shows the truth of the fact which he wishes to estop the other side from setting up.

The plaintiff here having shown in attempting to make out her title that her husband's claim was through a void grant, cannot estop the defendant company from saying that her husband had no title.

Assuming that the defendant company cannot set up the want of seizin in Wm. Sword, they rely upon the provisions of the Act of 1881, vesting in them the water lot in question.

This ground is met by the plaintiff by the contention that it is *ultra vires* of the Legislature of Nova Scotia to legislate as to the title of this water lot.

The defendant company submits that the view taken by Mr. Justice Ritchie is correct. And if the Legislature of Nova Scotia could not vest in the defendant company, as against the Government of Canada, a good title to this water lot, they could vest the title by estoppel as against the defendant company, which is all that the plaintiff claims, and had full power to deprive the plaintiff of the rights which she claims, and this has been done by the clear words of the statute, and no injustice is done by this construction, as the right to compensation is reserved.

The action was taken to the Supreme Court of Canada, the argument by counsel being heard in February last. Judgment was reserved and in view of the enormous amount of work to be adjudicated upon by the court, it is not at all probable that the result of the deliberations of their Lordships in regard to this important case will be made public before the October sitting of the court.

F. W. Webster vs. T. G. Watters et al.

Judgment was given in this case at the Court of Review, Montreal, on April 30th, by Mr. Justice Davidson as follows:—

By what plaintiff styles "saisie conservatoire," but which defendant asserts is really a "saisie revendication," about 30 tons of mica have been attached at the mouth of a mine on lot No. 23A, in the 2nd range of the township of Wakefield, county of Ottawa. Plaintiff claims to have certain privileges upon the products of the mine. His action was dismissed by the Court at Aylmer, and this judgment is before us for revision. McVeitty, Powell and Skead being then the owners, each for one undivided third of the minerals and mineral rights on the lot in question, on the 27th of October, 1890, made an agreement with plaintiff for the disposal of the mica which they might mine on lot 23, or other properties in which they were interested, or which they might buy, at the rate per ton of $200 for large, $100 for medium and $25 for small sizes. The following clauses are sufficiently important to be quoted verbatim:—

"The said McVeitty, Powell and Skead hereby agree with the said Webster & Co. to use all due diligence in searching for and taking out mica from the said lot No. 23.

"The said McVeitty, Powell and Skead agree with the said Webster & Co. not to sell to any other person or persons, firm, or corporation, any mica of the character and description aforesaid for the period of two years from the present date. It is understood and agreed by and between the parties hereto, that in case the said McVeitty, Powell and Skead shall dispose of the mineral rights in the said lot No. 23 in the 2nd range of Wakefield, that the purchaser or purchasers thereof shall be bound to carry out this contract with the said Webster & Co., and the said mineral rights in the said lot No. 23 shall stand charged with this obligation, not only as against the said McVeitty, Powell and Skead, but as against the future purchaser or purchasers of the said mineral rights, until the expiration of two years from the present date. It is further understood and agreed that the said McVeitty, Powell and Skead shall deliver to the said Webster & Co. at the cutting shop located near the mine as aforesaid."

This deed was registered against the property.

The vendors worked the mine for some time, and delivered between 100 and 120 tons to Webster. Then dissatisfaction arose as to new and severer methods of culling adopted by his agents whereby the rates agreed on were claimed to be largely shrunk, and that too in the presence of a rising and buoyant market. Finally the mine became flooded and work ceased. Then McVeitty, on the 21st May, 1891, Skead on the 2nd of June, and Powell on the 29th of the same month, each sold his undivided third interest in the "mines, minerals and mining rights" in and upon this lot No. 23A, to the defendant, Watters, who thereby became sole proprietor. Watters, in turn, on the 2nd of July, 1891, sold one undivided third to the defendant, Elmenhurst. All these sales were with warranty of peaceable possession and were registered.

The plaintiff's action followed on the 25th of August, and was directed against the five past and present owners above named. Subsequently discontinuances were filed as to McVeitty, Skead and Powell, leaving only Watters and Elmenhurst as defendants in the cause. Plaintiff, in his decleration, sets out the original agreement and impugns the subsequent transfers as being fraudulent and

illegal. He prays that the mica seized be declared his on payment of the stipulated prices, that he be adjudged proprietor and entitled to exclusive possession of all mica on the lot, or that may be mined therefrom up to the 20th of October, 1892; that the lot be held hypothecated and subject to these so-claimed privileges and rights: that the above transfers be declared fraudulent and illegal; that the defendants be declared bound to carry out the agreement of the 27th October, 1890, made with plaintiff, and in default of their doing so that they be condemned to pay plaintiff $40,000.

Separate pleas are filed by Watters and Elmenhurst. In either instance the facts alleged and the general grounds of defence assumed are identical. Denial is made of plaintiff's pretensions and responsibility, in any sense, for the agreement between plaintiff and the original owners is asserted. It is claimed to be a purely personal contract conveying no real rights upon the property.

Upon the discontinuance of the action against McVeitty, Skead and Powell the defendants produced a supplementary plea alleging that the nullity of these could not be demanded without the presence in the cause of their makers, and that a like objection existed against any condemnation in damages for breach of their contract, even if such had been set forth.

Watters and Elmenhurst bought with the knowledge of the bargain between the previous owners and Webster. They were also aware of its registration, but believed it to be a personal contract not imposing any charge upon the property itself, and further relied upon the warranties contained in their deeds. The suggestion is offered in the evidence that there had been an equitable fulfilment of the contract, as enough phosphate had been delivered to represent one ton a week for two years. Our judgment rests upon other grounds. Work had been stopped, delivery had ceased, and it is expressely and repeatedly sworn to that the sales to the present defendants were purely commercial transactions. They appear to us to be wholly untainted on the part of the buyers, with any purpose of ousting plaintiff from his rights. Knowledge of the agreement and of its registration does not constitute or create a presumption of collusion or fraud. Neither in fact existed. Did the original deed with Webster create a mortgage, servitnde or any formal real right in his favor? The question has already received a judicial answer. During the progress of the present action the plaintiffs sought for an injunction against Watters and defendants to restrain them, for the time being, from working the mine. In refusing the application, the Superior Court *a quo*, the Court of Review and the Court of Queen's Bench all pronounced against the existence of real rights. This judgment, in appeal, practically concludes further discussion on the point. We don't see how any other view could have been adopted. There remain to be considered the personal rights invoked by plaintiff. We find, as was found by the judgment appealed from, that the mica seized was not extracted by McVeitty, Skead and Powell, their output having been by them duly delivered to Webster, but by and at the expense of the present defendants, Watters and Elmenhurst, whose property it is. Moreover, the absence of real rights, the disappearance of McVeitty, Skead and Powell as defendants, and the quashing of the seizure, leave us with a purely personal action, of which no service has been made upon the present defendants within the judicial district of Ottawa. Judgment confirmed with costs.

Desulphurization of Pig Iron.

At a recent meeting of the South Staffordshire (England) Institute of Iron and Steel Works Managers, Mr. T. E. Holgate, R.S.M., read a paper on "Manganese and Sulphur in Pig Iron." He stated that at the works at Hoerde the basic Bessemer process of steel-making was carried on, and for a supply of molten pig for the converters, the metal was taken in the fluid state direct from the blast furnace, without any remelting being required. With regard to the results, as they had to use coke containing much sulphur, they found that they had great difficulty in keeping the sulphur in the pig iron constantly low enough, and they hit upon a plan of desulphurizing the pig iron whilst it was in the "mixer" by means of manganese. They found that if sufficient manganese were added to give an ultimate total of 1.50 per cent. and the molten metal allowed to stand at rest for about 20 or 30 minutes, then, whatever might be the quantity of sulphur previously, it would be reduced at the end of the period to something like .05 to .08 per cent. They worked a furnace on a manganiferous pig iron and used the product of this furnace to furnish the required amount of manganese. Therefore the average percentage of sulphur in one series of 15 casts from the blast furnace was 642 per cent., and in the metal as taken from the "mixer" .046 per cent. Another set of 28 tests of the metal as taken from the "mixer" gave an average of .032 per cent. of sulphur, the highest being only .064 per cent. Therefore he thought they might, from the results obtained at Hoerde, regard it as proved that any pig iron, whatever amount of sulphur it might contain within ordinary limits, if it also contained manganese equal to 1.5 per cent or upwards, or had sufficient manganese added to it to bring it up to this percentage in addition to that required to form an equivalent to the sulphur present, and if it be left at rest in a perfectly molten condition for twenty or thirty minutes, then the sulphur would be reduced to .08 or .07 per cent., or less than this, through the separation of sulphide of manganese. If the presence of the latter was desirable in foundry pig iron, it was much more so in that for forge purposes

The Spontaneous Ignition of Coal, and its Prevention.*

By Vivian B. Lewes, F.I.C., F.C.S., Professor of Chemistry, Royal Naval College.

(Concluded from April issue).

A few years ago, such an occurrence as a coal bunker on fire was rare, whilst at the present time hardly a week passes without some more or less serious cases occurring on the fast liners, and it is evident that there must exist some well defined cause for this enormous increase in cases of spontaneous ignition. On collecting evidence on this point, the first thing that strikes one is that bunker fires are almost entirely confined to vessels in which the bunker bulkheads are only separated from the funnel by a narrow air-space, or in close proximity to the boilers themselves, but where the bunkers are stepped back from the funnel casing and boilers, spontaneous ignition is a great rarity. Taking the case of a fast liner, it is found that the temperature in a coal bunker varies very considerably, according to its proximity to the air channel round the funnel casing. Close to the outside of the bulkhead the temperature is often as high as 200° Fahr. (93° C.) whilst inside 120° would be a fair estimate, and from the centre of the bunker to the side of the vessel, it is seldom above 70° Fahr. (24° C); the temperature, however, being higher near the iron decks, which, being in contact with the heated bulkhead, conduct the heat through the coal, and raise the temperature often up to 100° Fahr. It has been pointed out that if coal be kept at a high temperature, even though it be far below its igniting point, ignition is only a question of time; and if the bunker coal next the bulkhead be kept at 120° Fahr., any coal with a tendency to absorb oxygen will run a great chance of igniting within a few days. It is manifest that if this is the real cause of ignition, the seat of the fire ought to be found close to the heated bulkhead, but this is very often not the case, the mass of fire being found near the centre of the bunker, and sometimes even towards the sides of the vessel; but careful examination soon reveals the cause of this, as a line of charred coal is mostly to be found running from the heated bulkhead to the seat of active combustion, showing that the fire started by the high initial temperature has not had sufficient air near the bulkhead to do more than smoulder; but that as soon as it came in contact with a current of air passing up through the coal from the hatches in the decks, the smouldering mass began to burn fiercely.

In order to prevent spontaneous ignition of the coal under these circumstances, all that is necessary is to reduce the temperature of the bulkhead in contact with the coal, as if this is kept at a temperature not exceeding 82° to 90° Fahr., there is little or no fear of the oxidation of the hydrocarbons of the coal proceeding with such rapidity as to cause ignition in such a quantity of coal as can be carried in the bunkers; the iron decks, by subdividing the mass, also helping to reduce any risk. In order to reduce the temperature to the required extent, it would be necessary to make the bulkheads close to any heating surface, such as the funnel casing, double. Through this double casing sea-water would be allowed to circulate very slowly, and would effectually prevent any undue rise of temperature; whilst, to make the arrangements complete, a thermostat should be fixed on the inner plate of each bulkhead, which, if the temperature rose to 100° Fahr. (38° C.) would ring a bell in the captain's room, when the rate of flow of water could be increased until the required fall in temperature took place. Should this arrangement prove impossible from any structural cause, then a rapid current of air forced through the bunkers by means of a fan, or even an up-current formed by a good air-pump ventilator in the crown of the bunker, would go far to keep the temperature within safe limits. In a coal cargo, perfect ventilation is impossible on account of the mass of coal present, and, therefore, the hold should be battened down, and everything done to prevent imperfect ventilation, gas-tight bulkheads being a necessity for this purpose. In coal bunkers, on the other hand, on account of free access being obtained to both top and bottom of the coal, and also the small mass present, perfect ventilation is possible, and should be attempted, whilst the water bulkheads will do away with any undue rise of temperature.

Chemists have been repeatedly asked if analysis gives no indications by which a coal, liable to spontaneous heating, can be distinguished from another which is perfectly safe for storage or shipment in bulk; but up to the present time, the action has been so little understood, that no such differentiation was possible, but with a clear conception of the causes which lead to heating, it should be quite possible to do so. As I have shown, all coals, when heated to a temperature a little above that of boiling water, have their power of absorbing oxygen so increased that they will, in a few hours, absorb sufficient to give a perceptible increase in weight, and the greater their absorption power the greater will the increase be: and as it is upon this that the liability to heat depends, the amount of increase in weight would give a sure indication of the liability to spontaneous ignition. We have at present, however, no data to show what is a safe amount of absorption, and with what amount danger commences, and the owners of collieries yielding coal liable to heating are so anxious to prevent the fact leaking out, that there will be considerable difficulty in obtaining authentic samples to make the determination with. My own experience, however, leads me to think that if an air-dry coal does not contain more than 3 per cent. of moisture, and when powdered and heated to about 250° Fahr. in an oven for three hours does not increase more than about 2 per cent. in weight, it may be looked upon as a safe coal to store in bulk. I am perfectly aware that the precautions I have suggested will never, unless pressure is brought to bear upon them, be adopted by the owners of colliers, on account of the slight extra expense and trouble they would involve; but if Lloyds could be prevailed upon to lower the rate of insurance upon coal cargoes treated in this way, and substantially increase the rate upon cargoes in which these precautions had not been adopted, a class of disaster as appalling in nature as it is destructive in result would soon be entirely done away with.

* Paper read before the Society of Arts, March 2, 1892; with discussion thereon.

Discussion.

Sir JAMES DOUGLASS, F.R.S., desired to thank Professor Lewes for what he had done in the way of providing a way of safety for those who had to convey coal to distant parts. The method proposed certainly seemed a little troublesome to shipowners, but it was not very expensive; and if it ensured safety to coal ships, as it seemed to do, it ought to be adopted. He hoped Lloyd's would see their way to encourage owners to adopt these necessary precautions. He should certainly urge the adoption of the necessary precautions with regard to the storing of coal in bunkers in any case he had to deal with.

Mr. FRANCIS COBB thought, if the attention of Lloyd's was drawn to this paper, underwriters would very speedily fall in with the suggestion that properly protected ships should be insured at lower premiums than those which were not; and he should be glad if means were taken to distribute the paper amongst those interested. Up to the present it appeared that most people had been acting under a grave misapprehension. Considerable expense had been incurred in ventilating coal ships, especially those going to the west coast of America and the East Indies, and now it appeared that this was a step in the wrong direction. He knew of one case where an old American captain refused to have any ventilation, as he was loading his vessel for the west coast of America, and a fine iron ship alongside of him was ventilated at great expense; but in the end the old wooden ship delivered her cargo cool and in good condition, while the fine English ship was burned. The one captain closed his hatches as quickly as possible and never opened them again till he got to his destination, whilst the other put up wind-sails to blow air right through the cargo, which, at that time, they had been taught was the proper thing to do. If anything could be devised by which the liquid carbonic acid could be used without having a bottle for every eight tons of coal, which seemed to him impracticable, it would no doubt be very useful. If it could be carried in larger bulk and distributed where it was required, there would be no difficulty in fitting ships to carry it.

Mr. W. E. STANLEY THOMSON said he had been favoured by Professor Lewes with an early copy of the paper, and had had communications from him before, and he had therefore taken the trouble to make himself acquainted with the results of the inquiries which had been held since the report of the commission in 1876. Professor Lewes' theory was, to some extent, contrary to the opinion of some very able men who sat on that commission, notably Sir Frederick Abel and Dr. Percy, which had been generally followed by courts of inquiry since. In one case, an inspector or manager of mines expressed the opinion that, unless there were pyrites in the coal, it would not fire; and the general opinion of the courts, since 1876, had been that it was generally pyrites which caused spontaneous combustion. Professor Lewes challenged this entirely, and had given some statistics bearing out his view; but his information went no further than 1883; if he had taken the last three years for which the Board of Trade had made returns, he would have found that they gave an average of something like twenty-five coal laden ships per annum which were either known to have been abandoned or were missing, and 200 lives lost. This was a very serious matter, and, if Mr. Lewes were right, the existing precautions were altogether insufficient and illusory, though they were founded on the report of the royal commission. That commission called special attention to a paper by Sir Frederick Abel and Dr. Percy, explaining scientifically the cause of spontaneous combustion, in which a great deal of space was devoted to the part taken by pyrites, though later on they also explained that coal itself was liable to oxidation, and, after explaining the process, they expressly said that this oxidation of the coal was one of the causes, if not the chief cause, of spontaneous combustion. It was strange, therefore, that during all these years not one word had been said, in the course of the many enquiries which had been held, and in which the courts have often been in doubt, to suggest that this was the probable explanation of the ignition of the cargo. On the contrary, attention seemed to have been confined solely to discovering whether the coal in question had pyrites in it, and whether it had been sufficiently screened. Since 1876 there had been altogether thirty-four enquiries in which the courts found that the cargoes had fired from spontaneous combustion; but, to make a fair comparison, he had selected those in which the ships were bound to South America, or round Cape Horn. Of these there were twenty-three, of which in nine cases only did the courts find that pyrites were positively present in any quantity; in 14 it was either absent or present in such infinitesimal quantity that they were unable to assign

any cause for the fire. Then, too, the average time from leaving port in which the vessels fired was. where pyrites were present, 2 months and 23 days; when absent, 2 months and 20 days, and this was very important evidence as showing how little pyrites really had to do with firing these cargoes. He had tabulated these cases, classifying the information obtained as to the class of coal, whether wet or dry, the time the vessel sailed, ventilation, and so on, with a view to getting some explanation of the reason why some cargoes fired in, say two months, while other ships—sailing, apparently, under similar conditions as regards coal on board—had taken three months, or even longer, to fire; and it would be found that the conditions of heat and ventilation were important, and had very much to do with this. Vessels which went through the tropics during the sun's northward course would travel through the tropics at a time when they would have the longest period of extreme heat on the voyage; but if the sun were on its southern course the vessel would have the extreme heat for shorter time. With regard to ventilation, the courts seem to have had some difficulty in deciding whether iron masts, perforated below the decks, were injurious or not. Through ventilation was now always condemned, especially when lattices were used; but platforms and trunkways had also been deemed dangerous. The most important point, perhaps, was the management of the hatches, and on that he had collected the following information · Particulars are not always given in the reports as to the keeping on or taking off the hatches: but where such information is given there is abundant evidence to show that taking them off to cool the cargo when it has given evidence of heating, or to dig down and get at the seat of the fire, or to see how the fire is progressing, accelerates combustion in a most alarming way. For instance, the temperature of the *Nazpore's* hold was found to be getting very high—it showed 95° by the thermometer—and next day it was 110°. At this time the fore and main hatches were off, and by next morning the temperature rose to 120°. Still keeping off the hatches, the thermometer next day registered 130°, and then fire broke out. In the case of the *Mountaineer*, upon smoke appearing the hatches were taken off, but after trimming the cargo they were replaced and battened down for the night. Next day they were taken off to see how matters were progressing, but the smoke was so intense that the master closed up the hold at once; and after sundry minor explosions next day the ship finally blew up. This coal had little or no pyrites in it, and had not been much broken, nor was it wet when put on board. Here is another case, in which the coal was clean and dry, but a good deal broken, the *Gad's Hill*. When 96 days out smoke was noticed coming from the forehold. Digging down to the seat of the fire and douching the coals vigorously, they, in four days, believed that they had effectually flooded out the fire. Four days afterwards, however, smoke appeared from the after hold. Attempts to get at the seat of the fire proved a failure, for a foot below the surface the diggers were met by so much steam and smoke that they were obliged to desist. The hatches were then put on, in hopes of smothering the fire, but this failing, they were again thrown open to allow the heavy seas which were breaking over the ship to fall into the holds; but the fire increased so rapidly that, on the following day, the crew had to abandon the ship. In this case the usually supposed causes of spontaneous combustion were not present; and the combustion must have been developing a long time before the first appearance of smoke. How far, previous to the smoke, the opening of the hatches may have contributed to the combustion we cannot say; but the consequences of keeping off the hatches while digging, and uncovering them to allow the seas to wash in, are conspicuous in the rapidity with which the fire spread. Here. again, is an instance of combustion which probably had been in a state of quiescence for want of air, and was brought into vigorous operation through opening the hatches. The *Yuca* had a cargo which the court found had pyrites in it, but it had been put on board dry and not much broken. The vessel was 98 days out on her voyage, and it was necessary to trim the cargo, which had shifted. On opening the hole they found "no signs of heat or gas from the coal;" but next day two of the crew were nearly suffocated by gas, and on examination the hold was found to be full of it; but still there were no signs of fire. By way of precaution the hatches were battened down; but, having to get out the cable, they were again opened about twelve hours afterwards, and as the smoke was very great, they were soon put on, and battened down again. In the course of the next twenty-four hours the ship fortunately came in sight of land; but, meanwhile, her main hatch had been blown off, and the flames were coming out of her on both sides, fore and aft, whereupon the crew abandoned her. This is not the only case in which the crew have been deluded into the supposition that all was going well by finding only normal temperature at the surface of the cargo. From similar experience in the *Slieve More* and other cases, one might assume that combustion had been in active operation, but had lain dormant for some time for want of air, so that there would not be that intense heat at the bottom of the hold which would affect the temperature on the surface of the coal. Anyway, in the *Yuca* case the course of events positively shows how active is the assistance which the open hatches contribute in developing spontaneous combustion when there is a tendency to it in the coal at the bottom of the ship's hold. Next comes a case where the hatches had practically always been off. The *Carr Rock* had a cargo in which there was little or no pyrites; it was not more than usually broken, and was put on board dry. At starting the thermometer indicated 75° Fahr. in her hold; a month afterwards it was 98°, and in another month 120°, whereupon they dug down into the coal; and as at a depth of four feet it was palpable that there was fire all over the hold, they stopped work and clapped on the hatches. Next day the hatches were taken off to see how matters were progressing, but finding the fire was burning furiously they were soon replaced. Water was poured into the hold; in a few hours explosions occurred, and soon afterwards the crew were obliged to abandon the ship. Here, too, we have none of the usually supposed causes of spontaneous combustion—no pyrites, no wet, no coal in a very broken condition—but we have the fact that the hatches were constantly open, and the coal would probably have been put on board fresh from the pit in a very absorptive condition. We have therefore, an instance which actually bears out Professor Lewes' contention. From these illustrations, then, may we not assume, as a general principle, that the coal goes through a very simple process? It comes into the ship green, and that part of it which has been most broken, and lies at the bottom of the hold, immediately beneath the hatches, slowly heats. The air which surrounds it becomes warm, and ascends, while the cool air from above rushes in to take its place, and so supplies the oxygen required to assist in the process of combustion; meanwhile, perhaps, the hatches are off, but wet or rough weather sets in, and the hatches are battened down. The hold is then warmer, and combustion is accelerated so long as there is air within reach; and when that air is exhausted, combustion is at a standstill, and would actually remain quiescent so long as no air can get to it; but with the return of fine weather, the hatches are removed, the hot air then rushes up from below, a new supply of oxygen is drawn down to the now almost burning coal, and, in a few hours, the cargo is alight fore and aft. If this is a correct theory, Professor Lewes is perfectly right as regards keeping the hatches always closed. But now, as regards the sufficiency of the present precautions—assuming that oxidation of the coal and not pyrites is the cause of spontaneous combustion—the existing regulations are incomplete. It is simply required that the coal should not be broken more than could be helped, that pyretic coal should not be put on board wet, and that ventilation through the cargo should be stopped. But what about green coal which is freshly won from the pit, and in its most absorptive condition? What about the facilities on board, through the hatches, for its getting air to sustain and accelerate combustion. It seemed to him that the alarm thermometers suggested by Professor Lewes might be dispensed with, even with advantage, because what was wanted was not the exact spot in which the coal was on fire, but the fact of fire existing anywhere, and that would probably be given by the exit pipe for the gas surface. That gas was inodorous, but when the cargo was burning, there must be smoke, which could be seen, and then the only thing was to make for the nearest port. The carbonic acid seemed promising, but it had been tried and failed under some conditions. In one of the colonies, some years ago, a ship was specially fitted up for the special purpose of applying it when vessels on fire came into port, but on one occasion it was poured into the hold of a vessel for several hours without success. Last year a number of people were invited to see some experiments at Liverpool, and a large bonfire in a ship's hold was speedily extinguished, but that could hardly be considered an analogous case. Still he thought Mr. Lewes had made out a good case for the use of carbonic acid, and certainly he had contributed much information by his most interesting and valuable paper.

CHARLES MILES DeTRACY DOBSON.
(See our article "Head Him Off" in April issue).

MR. I. G. LORRAIN said he did a good deal of work on this subject some seven or eight years ago, and it was then urged upon him that an alarm was not what was wanted. A captain told him that he did not want to know that the cargo was on fire, he wanted to know what condition the hold was in before it got to that, so that he might take precautions. Charpontier's arrangement, which was somewhat similar to that now suggested, was met with the same objection. The carbonic anhydride arrangement was not new to the society, as he had made a similar suggestion in 1885, laying stress on its cooling action, as well as on its being a non-supporter of combustion, and in November, 1885, Professor Silvanus Thompson showed a diagram of the apparatus. With regard to putting a fuse in the mouth of the bottle, it was not always possible to have the bottle in the place where the fire broke out, but he had found a good arrangement was to add some insulating material near the mouth, and mount the fuse in such a way that it acted like a fuse in an electric circuit; then by putting a thermostat in places where the fire was likely to occur, and having a source of energy sufficient to supply an excess of current that might be relied upon to mel the fuse.

CAPTAIN ANDREW CUNNINGHAM thought, when Professor Lewes' views were subjected to a little wholesome criticism by practical men, they might lead to practical results. He had considerable experience with coal cargoes; and having come to grief with the first one, he learned so many useful lessons, that he never had another accident. His conclusions were somewhat at variance with those now put forward. He could not go into the chemical part of the question, but, it seemed to him, that moisture was the principal element in determning the combustibility of a cargo. It seemed a truism to talk of the oxidation of pyrites being the cause of ignition. It was like saying that a man died from want of breath. His experience, on his first voyage was much what Mr. Thomson had indicated, except that he omitted what every master was told by the skipper, that a cargo of that particular coal had never been known to take fire. He sailed from Dundee to San Francisco, and, wishing to be as careful as possible, he kept the hatches up, and had a trunk along the keelson, and an upright shaft too. After a time, when the weather got rougher, he put the hatches on, and was not in a hurry to get them off; but, 86 days out, he was told by the second officer that smoke was coming out of the fore hatch. He then took all the hatches off, and began pouring water down, and, after a time, the smoke disappeared. They continued pouring in water during the night, but the following day it became serious, and they began throwing coal overboard, until they got to the lower deck beams; then the coal began to get red-hot under the men's feet, and they had to stop. Then he turned the hose from a donkey-pump into the main hatch, filled the cavity with water, and put on the main hatches and battened them down. About midnight there was an explosion, and the next morning he was told that the men were coming aft to ask him to abandon the ship. However, he took off the main hatch, and found it as cool as an ice-house, the beams and timber being all covered with coal tar, and he never had any more trouble for the rest of the voyage. The lesson he learned was, as soon as possible after leaving home to insert iron rods down the main and after hatches, by means of which he could tell by the hand how the temperature was getting on. Perpendicular shafts were quite unreliable as a test of temperature; he had seen a ther-

mometer in one of them give a lower temperature than there was on deck, and at the same time he could hardly bear his hand on an iron rod not more than five feet off. He always dug out the main hatch down to the lower deck beams, so as to be all ready for putting water in. He thought the iron rods which he used as indicators might also be of use in conducting away the heat, and allowing it to escape into the air. He had never had any trouble since, though he had been more than once becalmed in the tropics. It was most dangerous to batten down the hatches, considering the large quantity of gas evolved. Professor Lewes had little notion of what shipowners were, or he would not recommend double bulkheads. The great point, in his opinion, was surface ventilation ; the hatches should always be kept open, and a ship properly loaded would never take in any water which would injure her. The thermostat might be a nice thing for a laboratory, but would not do for a sailor. He gathered that the *Carr Rock* was filled block up between the beams, and there could not be surface ventilation unless there were several feet to spare between the decks.

SIR JAMES DOUGLASS could not understand how Captain Cunningham could place so much faith in surface ventilation, seeing it was not at all uncommon in the North of England to see a heap of coal on fire in the open air.

THE CHAIRMAN (Sir Frederick Bramwell) said Professor Lewes, in the paper he read at Cardiff, and again in the one he had just read, had taken the first step necessary in devising preventive measures, viz., to point out the causes of the evil to be guarded against. He had disproved the pyrites theory, because, though he did not say it had no effect whatever, he had shown that with coal absolutely free from pyrites, there was sufficient heat generated by the absorption of oxygen to cause spontaneous ignition, unless means were taken to prevent it under the conditions stated. One striking point was the increase of danger as the size of the cargo increased, especially in tropical climates. Two things recommended, he thought, would be found practically impossible. Double bulkheads would be very costly to make and keep water-tight, and would take up a great deal of space. It was admitted that no one would use them except under the pressure of legislation ; but they could not legislate for foreign countries ; and, if too heavy burdens were imposed on English shipping, other people, not subject to the same restrictions, would come and take our trade away. Another suggestion was that coal should not be shipped until it had been a month out of the pit, but that might involve so much expense in removing from one place to another, or from one railway waggon to another, that it would be prohibitive. Coal-owners' profits were measured by pence rather than by shillings per ton, and would not bear much diminution in this way. The proposal for the introduction of thermostats into the bulk to show what was going on, reminded him of a difficulty which the late Sir William Siemens experienced from the deterioration of certain cables stored on board a vessel, when he discovered by means of electrical thermometers that there was a spontaneous rise of temperature in them. As a result of those experiments jets of water were flowed over the cables, and, finally, it became the practice to coil in a tank which could be filled with water. He did not see why the use of liquid carbonic acid should not be available. Many voyages would take place without any liberation of the carbonic acid, and even where it was liberated the cost would not be prohibitive. It was clear that if the temperature could be kept down ignition would not take place, and now-a-days it was becoming very common for large steamers to carry refrigerating apparatus. Where that was the case he did not see any difficulty in putting pipes near the bottom of the hold, through which a liquid, cooled down by the refrigerating apparatus, could be circulated, and in that way the heat could be abstracted from the bulk of the coal as fast as it was generated. He concluded by proposing a vote of thanks to Professor Lewes for his valuable paper.

The vote of thanks having been carried unanimously.

MR. LEWES, in reply, said Sir James Douglass had answered Captain Cunningham—with those views he did not at all agree—on the point of surface ventilation. Captain Cunningham had practical experience, and he had none, but he would rather go in a ship battened down, and with a 2-inch pipe to allow the escape of gas, than with any amount of surface ventilation. If cold air were continually supplied to the surface of the coal, it would soak down and take the place of the warmer air which had parted with its oxygen, and thus you provided the very conditions most favourable for setting up spontaneous combustion. Mr. Cobb had referred to the inconvenience of having to provide a cylinder for every eight tons of cargo, which he admitted, but it would be a great safeguard. It might, however, be arranged in another way. A large central cylinder, holding 1,000 feet, might be employed, and from that might run pipes along near the bottom into the cargo, pierced at intervals, with holes closed with fusible plugs ; they would melt at any point where heating took place, and allow the escape of carbonic acid. He was much obliged to Mr. Thompson for the valuable information he had given, and only differed from him when he said that the views he had put forward were at variance with those enunciated by Sir Frederick Abel and Dr. Percy. The report referred to distinctly pointed to the oxidation of the coal as having more to do with the matter than the pyrites ; indeed, he quoted the table he had given of the effects of moisture and pyrites from Dr. Percy's work on "Fuel." He should not have referred to the thermostats but for their being so universally used, and did not think there would be any difficulty with them. They should be so arranged as to give warning, not after firing had taken place, but before, so that precautions might be taken. The chairman objected to double bulkheads, but that was a favourite idea of his ; and they were absolutely necessary, if carbonic acid gas was to be used, as there must be a gas tight bulkhead between the cargo and the engine-room. If the coal were battened down, which was most important, there must be no leakage of the gas into the engine-room ; and the only way he knew of making a bulkhead gas-tight was by having it double, with water between. The use of refrigerating machinery would be very effective if the expense were not too great.

The Quebec Gold Fields—Down by the Chaudiere River.

From the Special Commissioner to the *Financial Standard* (London, Eng.)

Down by the Chaudière River the land of gold lies. In the ancient channels of the stream, in the tributaries of the river, the precious metal remains, as Virgil quaintly puts it, "unused by the hand of labouring man."

If Chaudière River drained the fertile plains of far-off California, her banks would he nightly lit with the camp fires of rugged miners ; but, alas ! her placid waters roll through Quebec.

The history of mineral Quebec remains unwritten, *i.e.*, there is little to write about as yet, only the omnipresent mineral to wit, phosphate, asbestos, and the gold down by the Chaudière River. The first is the finest the earth at present yields, the second leads the markets of the world, but the last remains dormant, while beneath the distant Southern Cross a gang of cut-throat rascals, —falsifying the too sanguine prognostications of the great Canning—flourish upon the bullion which the ethics of empire construction teach ought to be applied to its economic development

This is the enterprise of the lordly Saxon.

If the men who controlled the nascent Hudson Bay could view our follies and the follies of their sucessors in the great fur trade, they would disown us to a man.

Do you know, oh, most amiable John Bull, where Quebec is ? Heard of it lately, eh ? Do you know that down by the Chaudière River lies the great route to India, the East, and the fruitful West ?

Her stream, which rolls over sands of gold, debouches into a great waterway, which in its gigantic proportions, connections, and potentialities, excite the wonder and applause of this hemisphere. The name of that stream is the St. Lawrence. Did you ever hear of it, John Bull ? You have heard of Valparaiso, La Plata, and the Whitechapel atrocities, especially the latter, in which you were greatly interested, you remember ; but did you ever hear of the St. Lawrence—the queen river of the West ?

Perhaps you will presently tire of pursuing the puerile follies for which you are now notorious, and try to act like men. There is an empire to build out here, and patriotism is still fashionable.

You idle youths who betray infantile instincts, when with gold-nobbed canes between your lips you saunter carelessly down Regent street or Piccadilly, do wake up and be men. Suck the gold nob, if you will, but follow it through its devious career to the distant mine. Let the flame of enterprise leap up within you. Labour is still fashionable, and there is room for even a gold-nobbed cane out here in Canada.

Then you company promoters who may peruse these lines, even you would not feel lonesome, for your old chum Binder lives down by the Chaudière River. Keep your eye upon them, John Bull. They have got their eyes upon you. Whatsoever things are mean and shameless, these things are thine oh ! immortal promoter of "direct meats," and thine is the power and the glory, oh ! Binder !

Of his vainglorious boasting, his revelry and intrigue, we shall have occasion to write later, content now to warn you that his late defeat in the election of the 8th March will, doubtless, afford him leisure for the prosecution of his nefarious schemes, which, needless to state, do not embrace anything so honest as the gold down by the Chaudière River.

Howbeit, I fear that before substantial progress can be made in Chaudière Gold, radical modification of the present mining laws of Quebec must be instituted.

Indeed the whole history of gold mining in the Catholic Province is merely a dismal record of impotency and failures, principally due to the action of a past government, who coolly handed over the rights and titles to all the gold regions to a couple of lucky individuals, whose successors damp all enterprise with too stringent restrictions, and render a truly wealthy region as inaccessible as though it reposed in the heart of the wild Pamia. I have, however, reason to believe that efforts will be exerted to throw Chaudière and Ditton open to the adventurer, capitalist, or operator, and than shall Quebec, with her busy metropolis, her mines of asbestos, phosphate, and of gold, dispel the shadow of Mercier's sins.

The Deepest Coal Shaft in the United Kingdom. —In his annual report, Mr. J. Dickinson, Chief Inspector of Mines, England, states that the deepest mine in the United Kingdom in 1890, was the Ashton Moss colliery, where the deepest shaft is 2,880 feet. Great depths are attained in this and in another colliery in the Manchester district, by means of down-brow workings, the depth at the bottom of the engine-brows being in Ashton Moss colliery 3,105 feet, and in Pendleton colliery 3,000 feet.

Canada's Mineral Production in 1891.

From the advance sheet, recently issued by the Division of Mineral Statistics and Mines, we reproduce the following summary of the mineral production of Canada in 1891 :—

PRODUCT.	QUANT'Y (*a*).	VALUE.
Metallic.		
Antimony ore.....tons	10	$ 60
Copper (*b*).....lbs.	9,529,076	1,238,780
Gold (*c*).....ozs.	51,040	925,486
Iron Ore (*d*).....tons	68,979	152,005
Iron, Pig (value $368,901).. "	23,891	.....
Lead (*e*).....lbs.	588,665	25,607
Nickel (*f*)..... "	4,626,627	2,775,976
Platinum	.....	10,000
Silver (*g*)..... ..... ozs.	415,493	407,183
Total Metallic.....	.....	$5,535,097
Non-Metallic.		
Arsenic .....tons	20	$ 1,000
Asbestos ..... "	9,000	1,000,000
*Bricks .....thousands	173,808	1,047,311
*Building Stone.....cub. yds.	187,685	708,702
Cement ..... bbls.	93,779	109,086
*Coal.....tons	3,404,479	7,792,175
Coke (*h*)..... "	57,084	175,592
Feldspar ..... "	685	3,425
Fire Clay..... "	250	750
Flagstones.....sq. ft.	27,300	2,721
Granite .....tons	10,995	65,105
Graphite ..... "	260	1,560
Grindstones..... "	4,479	42,587
Gypsum (*i*)..... "	203,545	192,096
*Lime .....bush.	1,829,894	251,215
Limestone, for flux.....tons	11,376	11,547
Manganese (*k*) ..... "	274	6,951
Mica.....	.....	71,510
Mineral Paints.. .....tons	900	17,750
Mineral Waters.....galls.	427,485	54,068
Moulding Sand .....tons	230	1,000
Petroleum (*l*)..... ... .bbls.	755,298	1,004,546
Phosphate .....tons	23,588	161,693
*Pottery.....	.....	258,844
Pyrites ..... tons	65,362	196,086
Roofing Cement..... "	900	2,700
Salt..... "	45,021	161,179
Sand and Gravel (exports).. "	243,724	59,501
Sewer Pipe	.....	227,300
Soapstone.....tons	575	863
Terra Cotta (*m*)	.....	113,103
*Tiles..... ..thousands	11,779	140,799
Total non-metallic.....	.....	$13,882,765
Total metallic.....	.....	5,535,097
Estimated value of mineral products not returned, principally structural materials.....	.....	582,138
Total.....	.....	$20,000,000

*Some returns yet to be received.

(*a*) Quantity marketed, except when otherwise specified. Tons are of 2,000 lbs.

(*b*) Copper contents of Canadian ores at a market price of 13 cents per lb.

(*c*) Nova Scotia gold is calculated at $19.50 per oz., and that from British Columbia at $17.

(*d*) The amount of ore here given was partly marketed as such and partly smelted in Canada, affording the quantity of pig iron given in the next item.

(*e*) Lead contents of Canadian ores at a market value of 4·35 cents per lb.

(*f*) Nickel contents of matte and ore shipped from Sudbury at 60 cents per lb.

(*g*) Production of the Province of Quebec and the amounts exported from British Columbia and Ontario at 98 cents per oz.

(*h*) Oven coke, all the production of Nova Scotia.

(*i*) Production of Ontario plus exports from New Brunswick and Nova Scotia.

(*k*) Production of Nova Scotia plus New Brunswick exports.

(*l*) Calculated from the inspection returns at 100 galls. crude to 38 galls. refined oil, and computed at $1.33 per bbl. of 35 Imp. galls. The bbl. of refined oil is assumed to be 42 Imp. galls.

(*m*) Including fire-proof porous terra cotta and a certain amount of high priced ornamental pressed bricks.

The Coal Royalty Legislation in Nova Scotia—Full Report of the Mining Society's Plea for its Repeal before the Committee of the Legislative Council—A Strong Argument Presented.

To the Hon. Malachy Bowes Daly, Lieutenant-Governor of Nova Scotia :—

The petition of the undersigned lessees of coal mines in the Province of Nova Scotia, humbly sheweth : That there has passed the House of Assembly and the Legislative Council, during the present session of the Legislature of the Province of Nova Scotia, an Act entitled "An Act to amend and consolidate the Acts relating to mines and minerals."

The 116th, 117th and 122nd sections of the said Act are respectively as follows :—

"116. All ores and minerals (other than gold or gold and silver) mined, wrought, or gotten under authority of licenses or leases granted under the provisions of said chapter 7 of the revised statutes, fifth series, or of any Act heretofore passed by the Legislature of this province, shall be subject to the following royalties to the Crown for the use of the province, that is to say :—

"117. Coal.—Ten cents on every ton of two thousand two hundred and forty pounds of coal sold or removed from the mine, or used in the manufacture of coke or other form of manufactured fuel."

"122. All leases of coal mines issued after the passing of this Act shall contain a provision that the royalties may be increased, diminished or otherwise changed by the Legislature."

There has also passed the House of Assembly and the Legislative Council during the said present session, an Act entitled "An Act respecting the royalties on coal."

The first section of the last mentioned Act is as follows :—

"1. The royalty of ten cents per ton on coal as fixed by the said section shall be held to have taken effect on the 23rd day of February, 1892."

The present rate of royalty on coal is seven and one half cents per ton on all coal including so-called slack coal, or in some cases nine and seven-tenths on round coal, such rates being optional on the part of the lessess and mutually regarded and treated as equivalent.

The first mentioned proposed Act provides in the 116th and 117th sections for an increase in the royalty to be paid by your petitioners and all corporations or persons operating coal mines under existing leases, amounting to 33⅓ per cent.

The other proposed Act provides for the increased royalty being exacted retroactively, and it is submitted, is therefore specially objectionable independently of the grounds of objection to the main Act.

The previous legislation bearing on the proposed Acts is as follows,—Section 1, chapter 9 of the Acts of 1866 is as follows :—

"I. Lessees of coal mines in this province, their executors, administrators and assigns, holding leases from the Crown, or from the chief commissioner of mines, made since the first day of January, A.D. 1853, or hereafter to be made, shall upon giving notice in writing to the chief commissioner of mines at least six months previous to the expiration of such leases, respectively, of their intention to renew such leases respectively for a further period of twenty years from the expiration thereof, be entitled to a renewal thereof for such extended term upon the same terms, conditions and covenants as contained in the original lease, and in like manner upon giving a like notice before the expiration of such renewed term to a second renewal and extension of term of twenty years, from and after the expiration of such renewal term, and in like manner upon giving like notice before the expiration of such second renewal term to a third renewal and extension of twenty years, from and after the expiration of such second renewal term ; provided that at the time of giving such notices, and the expiration of such term, respectively, the said lessees, their executors, administrators and assigns, are, and shall continue to be *bona fide* working the areas comprised within their respective leases, and complying with the terms, covenants and stipulations in their respective leases contained, within the true intent and meaning of Section 104 of the Act hereby amended, and provided that in no case shall such renewal or renewals extend, or be construed to extend, to a period beyond 60 years, from the 25th day of August, A.D. 1886, and provided also that the Legislature shall be at liberty to revise and alter the royalty imposed under such lease in or after the year 1886.

Section 1031, chapter 9, of the revised statutes, fourth series (1875), is identical with the above section of the Acts of 1866, except that it does not contain the concluding proviso, that is to say the words :—

"And provided, also, that the Legislature shall be at liberty to revise and alter the royalty imposed under such lease in or after the year 1886."

No such provision as this latter is contained in any part of the Consolidated Acts of 1873.

Section 105, of chapter 7, of the revised statutes, fifth series (1884) is as follows :—

"105. The General Mining Association (limited), and other lessees of mines, other than gold and gold and silver mines, in this province, their executors, administrators and assigns shall, upon giving notice in writing, to the commissioner of mines, at least six months previous to the expiration of their leases, respectively, for a further period of twenty years from the expiration thereof, be entitled to a renewal thereof for such extended term upon the same terms, conditions, and covenants as contained in the original lease, or as prescribed by this chapter, or by any Act that may be passed by the Legislature of this Province, and in like manner upon giving a like notice before the expiration of such renewal term, to a second renewal and extension of term of twenty years from and after the expiration of such renewal term, and in like manner upon giving like notice before the expiration of such second renewal term, to a third renewal and extension of twenty years, from and after the expiration of such second renewed term, provided that at the time of giving such notices, and the expiration of such terms, respectively, the said lessees, their executors, administrators and assigns, are, and shall continue to be *bona fide* working the areas comprised within their respective leases and complying with the terms, covenants and stipulations in their respective leases contained within the true intent and meaning of section 107 of this chapter ; and provided that in no case shall such renewal or renewals extend, or be construed to extend, to a period beyond eighty years from the date of the original lease, but the renewed lease shall not include in respect of each mine worked, a larger area than five square miles."

"(*e*) In the case of leases that are eligible for renewal, in which the conditions of renewal embodied therein are different from those prescribed by this chapter, and the lessees thereof are unwilling to have such conditions altered, the commissioner shall have power to renew said leases on the terms contained therein and as prescribed by chapter 9, Revised Statutes, fourth series, and no other."

Section 4 of chapter 4 of the Act of 1885, is as follows :—

"4. All leases of coal mines issued after the passing of this Act shall contain a provision that the royalties may be increased, diminished, or otherwise changed by the Legislature."

All leases in existence previous to the 25th day of August, 1886, expired on that date and were, with leases afterwards issued from time to time, renewable according to the terms of the Acts above set out, and the terms of the leases themselves on the corresponding dates in the years 1906, 1926 and 1946.

Your petitioners submit that the re-enactment in the Revised Statutes of 1873 of section 1 of the Act of 1866, without the proviso under which the Legislature was to "be at liberty to revise and alter the royalty in or after the year 1886," conferred upon all the holders of then existing coal leases, and upon all subsequent holders of coal leases up to the year 1884, when the revised statutes, fifth series, were promulgated, an absolute legal right to renewals of their leases up to the year 1946, without any increase in rent or royalty.

As to section 105, of chapter 7, of the revised statutes, fifth series, above set out, your petitioners are advised, and they submit that in construing the portion of this section which provides that lessees

"Shall be entitled to a renewal upon the same terms, conditions and covenants as are contained in the original lease, or as prescribed by this chapter, or by any Act that may be passed by the Legislature of this province," it must be assumed either that it was not the intention of the Legislature to provide for future legislation legalizing the imposition of an increased rent, in violation of a lease defining what that rent should be, or on the other hand if the language used as to the terms of renewal be considered broad enough to cover the matter of an increase of rent, then it is submitted that that Act itself was improper, and that the present Act which proposes to legalize a specific increase of royalty in violation of existing contract rights, should not receive your honour's assent.

Further, as to this last mentioned section, your petitioners submit that even if upon its proper construction it would include a right on the part of the Legislature to increase the royalty payable under then existing leases, such increase could be stipulated for only at the time of the renewal in the year 1886, of the leases respectively, all of which were to expire, and did expire in that year, so that the renewal being once made, the royalty could not legally be increased until the next following renewal date.

As to section 9 of chapter 4 of the Acts of 1885 above set out, your petitioners are advised, and they submit that upon its true construction, it relates only to leases to be issued subsequently to its passing, and that it does not relate to agreements merely expressing the rights of the parties by virtue of leases previously issued.

Your petitioners submit that there is clearly no legal ground for giving to the language here used an *ex post facto* operation, seeing that there is ample office for the words to perform in connection with original leases to be issued after the passing of the Act.

For the reasons above indicated, your petitioners submit that the proposed legislation in a most substantial and serious manner invades the vested rights of your petitioners, secured to them by contracts solemnly entered into, on the faith of which they have invested very large sums as capital in the various coal mining districts of this province.

By far the greater portion of such capital has been invested by persons residing outside of this province, and they, as well as others residing in Nova Scotia, would direct your attention to the breach of their contract rights which the proposed Acts involve as above set forth, and your petitioners humbly pray your honour to withhold your consent to the said Acts.

And your petitioners as in duty bound will ever pray, etc.

(Signed) THE MINING SOCIETY OF NOVA SCOTIA, H. S. POOLE, PRESIDENT.
" THE GENERAL MINING ASSOCIATION.
" THE ACADIA COAL COMPANY (LIMITED.)
" THE INTERNATIONAL COAL COMPANY (LIMITED.)
" THE CALEDONIA COAL AND RAILWAY COMPANY (LIMITED.)
" THE GLACE BAY COAL MINING COMPANY (LIMITED.)
" THE GOWRIE COAL COMPANY (LIMITED).
" THE CUMBERLAND COAL AND RAILWAY COMPANY (LIMITED.)
" THE INTERCOLONIAL COAL MINING COMPANY (LIMITED.)
" THE LOW POINT, BARRASOIS AND LINGAN COMPANY (LIMITED.)

MR. HENRY, Q.C.—Mr. Chairman and Gentlemen,—I appear before your committee as counsel for a number of corporations who have invested capital in the development of the coal mining industry of the province, and who are actively engaged in that interest at the present time, as well as for a number of persons who are interested in areas which are not now being worked. The questions involved in this enquiry divide themselves into two aspects : First as to the actual rights of persons who have invested large amounts of money on the faith of the existing law of the Province in relation to this matter ; second, in respect to persons who are seeking to bring about the investment of further capital. These two classes are manifestly similarly and diversely interested. The question may be regarded as almost exclusively a moral one ; it is a question not so much of power as of propriety ; it is a question not so much of what the legislature may enact, as of what it ought to enact or abstain from enacting. I am limited to a very short time to discuss a large and broad-reaching question, a question affecting not only the interests, but the honor of the country, inasmuch as it affects the opinion that will be held abroad of the permanence of the rights of parties investing capital within the territorial limits of the Province. To confine myself within the short space of time allotted to me, I must eliminate a good deal of matter which otherwise might properly be dealt with. I begin, then, by calling the attention of the committee to the fact that in 1873 there arose or came into existence a certain important right on the part of every holder of a lease of coal mining areas in the Province of Nova Scotia, namely, the right expressed in the 102nd section of chapter 9 of the Consolidated Statutes of 1873. That right was expressed in the following words, which I will read :—

"Lessees of coal mines in this Province, their executors administrators, and assigns, holding leases from the Crown, or from the Commissioner of Mines, made since the first day of January, A.D., 1858, or hereafter to be made, shall upon giving notice in writing to the Commissioner of Mines, at least six months previous to the expiration of such leases, respectively, of their intention to renew such leases, respectively, for a further period of twenty years, from the expiration thereof, be entitled to a renewal thereof for such extended term upon the same terms, conditions and covenants as contained in the original lease, and in like manner upon giving a like notice, before the expiration of such renewal term, to a second renewal and extension of term of twenty years from and after the expiration of such renewal term, and in like manner, upon giving like notice before the expiration of such second renewal term to a third renewal and extension of twenty years from and after the expiration of such second renewed term ; provided that at the time of giving such notices, and the expiration of such terms respectively, the said lessees, their executors, administrators, and assigns, are and shall continue to be bona fide, working the areas comprised within their respective leases, and complying with the terms, covenants and stipulations in their respective leases contained, within the true intent and meaning of section 109 of this chapter ; and provided that in no case shall such renewal or renewals extend, or be construed to extend, to a period beyond sixty years from the 25th day of August, A.D., 1886."

Now that comprises the whole of the legislative expression of the rights of the parties, under coal leases, from the day that law was promulgated. Speaking generally, it may be said that that section defined the rights of coal lessees in the Province down to the present time, for, though in 1885 another Act was passed, it is submitted with every confidence that the Act of 1885, providing for the right on the part of the legislature to increase or diminish the royalties from time to time payable by the coal lessees, must be restricted in its operation to rights arising for the first time between the Crown and lessees after the passage of that Act. From 1873, down to the present time, every individual and every corporation interested in, or holding coal areas under the law of Nova Scotia, had a right to believe, and had a right to act upon the belief, that they had an inalienable right to ask for an extension of time on compliance with the terms in section 102 just read, keeping and observing the terms of the then existing law. Neither the Act of 1885 nor the Consolidated Statutes of 1884, which modify the rights of lessees at that time, upon a true construction, amount to a giving to the

legislature by express provision the power to do what is sought to be done by the bill now before the House. The bill now before the House proposes in no uncertain terms to subject the lessees of all the coal areas in the Province, carrying on the mining of coal, to an increase of thirty-three-and-a-third per cent. in the rental that they are now paying. It matters little whether the increase is 25 or 33 per cent., for if it would be discreditable, and I use the term with deference, to raise the rent contrary to the terms of the contract, the opprobrium to be attached to the Act would not be measured by the amount of the increase. The proposal in the measure under consideration is to raise the rental of persons who had the right to regard their rental as being fixed thirty-three-and-a-third per cent.; to impose upon them by an enforceable law of the Province, without any right of objection on their part, an increase in their rent. It does not require argument to show that if it is wrong that "A. B." should be given by force of legislative enactment the right to break his contract, it is equally wrong to give the Legislature the right to break their contract. In the one case the courts can give a remedy; in the other it depends upon whether there resides in the Local Legislature the power to break its contracts. Probably it has such a power, but, if so, there is all the more reason why a high regard should be paid to the principles by which the rights of individuals are regarded as being secured, and not to be dealt with upon a different principle from any others in a court of law. Now these parties had the right to go to the Government and get their leases renewed upon the same terms as before, a right which is common and perfectly familiar with regard to real estate. The Act before the House proposes to raise the rental thirty-three-and-a-third per cent. We say that that is an Act which is unjustifiable. No amount of exigency in the financial affairs of any country would justify resorting to such a means of raising revenue as that. It reminds one of the way in which King John used to get revenue out of the Jews by pulling their teeth. I am serious in suggesting that if it is the case that these corporations had these legal rights, which must be regarded as sacred, and as constituting part of their personal property, it is not competent as a matter of legislative policy, even admitting the power of the Legislature, to take that property away from them, which is practically what is involved in this bill. Now let us see what the position of these companies is. Let me take one of them as an example. The Glace Bay Company held three leases granted in the years 1862, 1863 and 1865, respectively. These leases were outstanding and never surrendered, and they continued to govern the rights of the parties up to the year 1886. In 1886, by reason of the coming into existence of the law contained in the fourth series of the statutes, to which I have already called attention, the Glace Bay Mining Company became entitled to receive a renewal lease upon the same terms, with regard to royalty, as those contained in their original lease, which I may mention, for the sake of avoiding confusion, was six pence currency. But in the meantime this legislature passed the Act of 1885, to which I must call the attention of the committee for a moment. That Act provided that thereafter all leases should contain a provision, providing for the right upon the part of the legislature to increase or diminish the royalties from time to time. That is to be found on page 10 of the Act of 1885. Now, if that Act, according to its proper interpretation, should be held to be applicable to leases issued previous to the passage of the Act, instead of attacking the propriety of the bill now sought to be made law, we would have to go back and attack that section of the Act of 1885 as a deliberate inroad upon the rights of the lessees. But upon the true construction of the section, the courts would be bound to hold that the provisions of the Act of 1885 did not apply, except to leases issued in the future. That is, it did not apply to existing rights, but must be confined to contracts arising for the first time after the passage of the Act. The section reads as follows :—

"All leases of coal mines issued after the passing of this Act shall contain a provision that the royalties may be increased, diminished, or otherwise changed by the legislature."

If that section really applies to existing rights we have to admit that at that time a violation of the principles, the soundness of which will be admitted by every intelligent man was committed. But we say that it was competent legislation, for it provided only for the case of corporations which should first become lessees after the passing of the Act, and we contend that it could not be held to affect the rights of parties under the existing law. Whatever question there may be as to the undesirability of making such a law, even as respects leases to be issued in the future, for the reason that such a power, subject to the whim of the government, would be unsatisfactory to capitalists abroad, it must be admitted that, so far as the interests I am now advocating are concerned, there would be no invasion of existing rights. Now, why does that clause not apply to existing leases? The language of the Act is: "All leases of coal mines issued after the passing of this Act." Now, at that time all the rights I am advocating existed. Some of them existed by virtue of leases long previously issued. All of them involved the right on the part of the lessees to get the renewals on the same terms that the existing leases contained. Now, what would happen when the leases came to be renewed? There would be documents issued covering a new period of time, but which would be in reality nothing more than a continuation of the old period. These documents are called renewals. They are a re-statement of the old conditions in a document which carries the provisions and rights of the parties over a new period of time; only that, and nothing more. Therefore, inasmuch as it is shocking to an ordinary sense of fair play to break a contract, even though it be broken by a Legislature, the courts would, beyond all peradventure, hold that Act to apply to leases arising afterward; for to impute any other intention to the legislature would be to impute the intention to break a contract. That would be something discreditable, and something which the courts would not impute if there was any other way of giving effect to the language. Inasmuch as it would be held to be discreditable in any legislature to seek to take away a vested right, the courts would unquestionably construe the language so as to apply to new rights arising subsequently. That argument I need not elaborate, but I may say that we have in support of it the opinions of three or four lawyers, whose opinions have been sought without regard to politics, and who have all given it as their solemn, and confident opinion that the language in the Act of 1885 does not mean that the Government shall have the right to impose new conditions with regard to royalties upon persons having existing rights coming forward and demanding renewals, which up to that time they had the right to demand. But even if in 1885 this Legislature committed itself to a course of action which savored of unfairness or oppression, it does not follow that it would be justified in resorting again to a similar course now, but, if I am right, the Act under discussion undertakes, by force of legislative power, to affect the beneficial ownership of all these proprietors to a serious extent, and involves a breach of public obligation; it involves the apprehension, by people who have invested large amounts of money, that contract rights are not to be respected in the Province of Nova Scotia. Parties may go to their friends and say that they hold leases of property on certain terms, and may induce them on the faith of such assurances, to put in large sums of money, and then they may find themselves called upon to pay a different rent, and the enterprise, instead of being a fairly promising one, may become disastrous, and all on account of a breach of faith on the part of the people of the Province, represented by the Legislature. If the Act of 1884 gave these people what I say it did, this supposition is not improbable or extravagant. If it did not, there is no argument for me to make. I challenge the promoters of the bill to show that from 1873 down to 1885, these people did not enjoy the rights I say they did. Of course our main contention is that this amounts to a legislative breach of contract, and a deprivation of citizens and foreigners of actual existing rights by the instrumentality of an Act of Parliament.

THE CHAIRMAN—Your argument would involve the idea that no change could ever be made.

MR. HENRY—If a clear contract is made, it does not make any difference how long a period it covers. The exigencies upon which it is proposed to break it, must be great indeed. But let it be understood that while I, for one, am ready to admit that in the Local Parliament resides the power to cut down or impair or destroy private rights, it follows as an incident to the existence of that power, that Parliament must, by reason of the possession of such a power, be careful to see that it does not break faith with people lightly, and bring the country into disrepute. I understand that the Government in promoting this bill disavow any intention of breaking contract rights, so we need not discuss the propriety of their doing that as a matter of legislative possibility.

MR. B. G. GRAY—The Chairman spoke about making a contract for all time. That is not the case here, as we have express limits in point of time. The contract is not for all time, but must terminate at a definite time. There is first a period of 20 years, and this may be extended by renewal to 40 years, but it comes to an end absolutely at the end of 60 years.

MR. HENRY—Section 105 of Chapter 7 R. S. (5th series), reads as follows :—

"The General Mining Association, 'limited,' and other lessees of mines other than gold or gold and silver mines, in this province, their executors, administrators, and assigns, shall upon giving notice in writing to the Commissioner of Mines at least six months previous to the expiration of their leases, respectively, of their intention to renew such leases, respectively, for a further period of twenty years from the expiration thereof, be entitled to a renewal thereof for such extended term upon the same terms, conditions and covenants as contained in the original lease, or as prescribed by this chapter, or by any Act that may be passed by the Legislature of this Province, and in like manner upon giving a like notice before the expiration of such renewal term, to a second renewal and extension of term of twenty years, from and after the expiration of such renewal term, and in like manner, upon giving like notice, before the expiration of such second renewal term, to a third renewal and extension of twenty years from and after the expiration of such second renewal term, provided that at the time of giving such notices, and the expiration of such terms respectively, the said lessees, their executors, administrators, and assigns, are and shall continue to be bona fide working the areas comprised within their respective leases, and complying with the terms, covenants, and stipulations in their respective leases contained, within the true intent and meaning of Section 107 of this chapter; and provided that in no case shall such renewal or renewals extend, or be construed to extend, to a period beyond eighty years from the date of the original lease, but the renewed lease shall not include, in respect of each mine worked, a larger area than five square miles."

It is in this section probably that we are to look for the first attempt in any way to provide for a right on the part of the Legislature to change the terms of tenure of leases of coal mines as contained in the leases. Subsection (*e*) of the same section reads :—

"In the case of leases that are eligible for renewal in which the conditions of renewal embodied therein are different from those prescribed by this chapter, and the lessees thereof are unwilling to have such conditions altered, the Commissioner shall have power to renew said leases on the terms contained therein, and as prescribed by Chapter 9, Revised Statutes, Fourth Series, and no other."

What happened in 1886, in connection with the renewals of the leases was this: Renewals were prepared which contained an express provision in the terms of the Act of 1885, with regard to the power of the Legislature to alter, increase or diminish the royalties, and these leases were accepted in a good many cases by companies, who either did not observe the peculiar wording of the leases, or who did not realize that it constituted a change from the preceding form, which is entirely different. It will be necessary, in order to prevent confusion, to point out the substantial nature of the difference between these two forms, but at present I will content myself with saying that with regard to the language used in Section 105, Chapter 9, of the Statutes of 1884, the most that can be said of it is that it purports by a general term to give powers to change the terms of the leases, so as to give the Legislature power to increase the royalty. It may be said that the language is broad enough to include so extraordinary and improbable an intention, but even if it does so, it only gives power to the Legislature to do a wrong, and it is still for the Legislature to say whether in using language which might involve a matter connected with the general administration of the mines, it was meant that the Legislature hereafter should understand by the language used in 1884 that it was to have a right to exercise a power that would be otherwise a wrong. It is for the Legislature and this committee to say whether under the power to change the terms of leases, they are to abstain from all question whether it is wrong to break a lease and to heap burdens upon these people, or to do a thing that is obnoxious to all notions of legislative policy. It does not advance the argument a particle to show that in 1884 there was a general power given to change the terms of leases. It may be that there is good reason to interfere by changing the terms. The terms may be inconsistent with the general management of the mines, and it may be desirable on that account to change them, but there can be no cogent reason except impecuniosity, which is no reason at all, for giving authority to raise the rent. We know that the subject of mines is one of public and general interest, and it may be that there is something in the terms of the leases which constitutes an obstruction to the exercise of the general policy, but no such reason can exist for raising the rental because it is necessary for the province to raise money from some source or another. This, I think is a conclusive answer to the suggestion as to the meaning of the words in the Act to which our attention was called. With regard to the impropriety of making a man pay more for property upon which he has expended large sums of capital, a humble illustration will suffice. Suppose that a man rents a farm upon which he grows potatoes only, and suppose that instead of paying so much an acre for the land, he agrees to pay three cents a bushel for every bushel of potatoes that he raises, and that an agreement is entered into by which he is given the land on these terms for a period of 20 or 30 years. Suppose that on the faith of this agreement he goes into possession and erects houses, and barns, and so on. After he has been working for ten years or so, his landlord comes to the Legislature, and says: "I am a little hard up. I agreed with so and so to let him have my place for a term of 20 or 30 years to grow potatoes, for which he was to pay me a royalty of three cents a bushel. He has been doing pretty well, and I think that now he ought to pay me six cents, or give up the enterprise." Will any lawyer, or farmer, or business man or miner, say that there is any difference between changing the terms upon which people have invested in the heavy works involved in mining, by raising the rates of royalty, and the injury that would be involved to the man who undertook to raise potatoes, by violating the terms of his contract? I say that there is no contract to permit of such a change unless the reception in 1886 of renewals which contained language that they were not obliged to be bound by, and their failure to realize that the language did them an injustice, is to be regarded as the making of a new contract. I say that these people stand before the Legislature to-day as they might have done in 1886, and say that they will accept no document which contains an assertion of a right on the part of the Legislature to change the rent that they are to pay for mining coal in the areas leased. Possibly some of these corporations did receive leases in 1886 which contained words, which, if it is said that they are bound because they did not discover the meaning, would bind them as a matter of acquiescence and consent, but I do not think it can be seriously argued that the circumstances under which the renewals were given amounted to anything that, on a fair view of it, would be regarded as a conscious acquiescence in the use of this language to change the terms with regard to the rent. Then I must point out why the companies did receive the leases. If some companies are not to be bound by the fact that they received the leases into their possession, other companies refused to receive them, and took leases which are in the terms of the Act passed in 1886, to which I have

not yet called attention. This Act contained a short provision at the end of one of its sections, which gave the Legislature, by express agreement, liberty to revise and alter the royalty in or after the year 1886. Now, it will be necessary to say a few words with reference to the condition of a company which refused to accept the lease with the language based upon the Act of 1885, but, instead, received a lease incorporating the language of the Act of 1866 to which I have referred. The majority of the leases received in 1886 contained the language provided for by the Act of 1866, and did not contain the language in the terms of the Act of 1885, expressly giving the Legislature the right to increase or diminish the royalty from time to time. I refer now to the acts of 1866, Chapter 9, Section 1, which is identical with Section 102 of Chapter 7, of the statutes of 1884, which gave the Government the right to renew on the terms of the original leases. The two sections are identical down to the last clause of Section 1 of the Act of 1866, which reads as follows :—

"Provided that in no case shall such renewal or renewals extend, or be construed to extend, to a period beyond sixty years from the 25th day of August, A.D., 1886, and provided also that the Legislature shall be at liberty to revise and alter the royalty imposed under such lease in or after the year 1886."

That provision of the Act of 1866 was deliberately dropped in 1873. Various publications were issued by the department re-enunciating the law as constituted by the Act of 1873.

THE CHAIRMAN—Do you say that the leases which were not taken out under the terms of the Act of 1885 were taken out under the terms of the Act of 1866?

MR. HENRY—Yes, and this brings us to discuss for a short time the companies that have leases under the terms of the Act of 1866. Assuming for the sake of argument, that they are bound by the terms of that Act, having insisted upon having those terms in their renewals, as distinguished from the terms offered to them, we come to the question what right or liability, rather, is imposed upon that class by virtue of this language, which is the same as asking what is the meaning of the proviso in the Act of 1866. Bearing in mind that all these leases were to expire in 1886, which was solemnly and carefully provided for, and there was not a lease that did not expire in 1886, the purpose of the whole of the section is to provide what is to be done at the period of renewal. In that connection I will read it again. It is clear from this that 1886 was the time when the renewals were to take place if at all. The Act does not provide for any interference with the rental between 1866 and 1886. It is clear that the Legislature was to have the right to make the change in 1886. *Query*. When did it commence to have that right? Does it not strike even a non-professional mind that the Act provided for the making of new terms for each renewal? That the change was to be made in 1886, if at all? At that period another tenure is entered upon for another period of twenty years upon terms which may be ruled upon by the Legislature. Then in 1906 another term is entered upon when new terms can be fixed. Then in 1926 still another term is entered upon.

THE CHAIRMAN—Your argument is that the renewal is good for the twenty years?

MR. HENRY—Yes, and this view is concurred in in an opinion carefully prepared, after full investigation, by Mr. Borden, which the committee is at liberty to peruse. It is also the opinion of Messrs. Drysdale and Newcomb, especially I believe of Mr. Newcomb. If it is not felt that we have legal talent enough here, it should be sought elsewhere. The view expressed by these gentlemen is the view that we say the court must take, and this is exceedingly important. The argument is easy to make and to understand. It is that, taking the whole section together, you find that the one thing to be done was to provide what was to be done in connection with the renewal of the relation of lessor, and lessee, by a new document, the lessee having the right to demand a renewal, and the Government being bound by the terms of the leases to grant it, but having the right to say what the rent should be. This right was not a right to interfere during the twenty years, but a right to fix the rent for the renewed period, as it was fixed for the original period during which, as it has been shown, the Legislature had no right to interfere. Now, what happened? When these lessees took the renewals in the terms of the Act of 1866, they took the best thing that they could get, and we have to see what they got amounted to. The words of the Act were: "Provided also that the Legislature shall be at liberty to revise and alter the royalty imposed." Is that a mere statement of the law, or does it give the Legislature the power to alter the rate of royalty from day to day, and from year to year, and from time to time? I submit that it does not. The most that it means is the re-statement of the rights that the companies had. Admitting for the sake of argument that the companies are now liable to have the rate altered in the year 1906, they are not liable to have it changed before that time, and to do so would be breach of contract. We are willing to submit this point to any reputable judges. Therefore we cannot agree with the Provincial Secretary when he says that he does not intend to commit a breach of contract. The operation of the mines is often a boon to the province alone, while it is a source of loss to the people who put capital into the enterprise. We all know how delicate the balance with regard to the trade is, and how small a burden will destroy an enterprise. A few cents a ton added to the freight will keep the coal from markets that it now reaches, while a few cents taken off will enable it to go further. The burden now proposed will not only impair the rights of persons who have now their money invested in the mines, but it will deter persons who have invested, or are desirous of investing in other enterprises. Surely in this enlightened age, morality and stability should be the governing considerations. If the proposed increase constitutes a breach of contract, it will be a serious thing for the Legislature to sanction it; if it be not a breach of contract, we will have no right to complain on that ground, and it will become in that case a question of expediency, whether the enterprises can stand the burden proposed.

MR. H. S. POOLE (the Acadia Coal Co.), said that many of the companies were not present other than by representatives. (The Chairman here stated that he had received telegrams from a number of companies authorizing Mr. Poole to speak for them). The Premier and the Attorney-General had stated that they did not intend to use the power of the Legislature to over-ride the terms of the leases, but claimed that they were acting within their powers as lessors. If they were sincere in this opinion they should not object to allowing the contention of the lessees, which is a purely legal one, to be tried in court or arbitrated on as the lessees desired. The holders of the leases desired to approach the committee as legislators and landlords. Those holding leases issued since 1886 make no claim of rights interfered with; they approach the Legislature with a request for clemency and a careful consideration, if prepared to receive them, of facts confirming their contention that the average returns from coal mining did not warrant an increase. Other lessees appealed to them as to landlords to yield them the conditions of their contract. The Attorney-General had said that he would blush if he thought that it was for a moment intended to commit a breach of contract in this legislation; he claimed that the Government had the right to make the proposed increase. The Premier had impressed upon the holders of the leases the power of the Legislature, and had said that it could take away private property. When it came to the question of property the holders of the coal leases received a good deal of sympathy from gentlemen representing other branches of mining industry. There were present here representatives of iron, gold and quarrying interests, who all felt that the security to the titles of their properties was of vital interest to their shareholders. Touching the question of legislation they had been told that they had nothing to say but to appeal to the clemency of the Legislature. He believed that there was a right of appeal to the Governor-General, and perhaps to England. The Prince Edward Island Legislature years ago had passed measures confiscating the lands of absentee landlords, but when the appeal went home their action was disallowed and a commission was appointed to indemnify the landlords and the confiscation laws were disallowed. A year ago the Province of Quebec passed a mining law which included minerals not included here, phosphates for instance. There was a great agitation against the law and an appeal was made for its disallowance. A correspondence ensued. He quoted from the letters of the Minister of Justice, Sir J. S. D. Thompson, and his deputy, Mr. Robert Sedgewick. In the end the province agreed either to withdraw the bill or to modify it. In the Province of Ontario they passed the Mining Act of 1892, giving certain rights and privileges to the lessees and at the same time imposing royalties, but they were particular to distinguish as to vested rights under titles previously granted. The increase proposed here would be of considerable moment to the holders of leases. As had been already intimated, if this law had been enforced last year the books of one large concern would have shown a debit instead of a small credit.

MR. R. G. LECKIE (Londonderry Iron Co.) desired to state that the effect the passage of the bill would have upon the manufacture of iron. At present the coke used in the manufacture of iron was made from slack coal. Slack coal had been free because it was an inferior product and contained impure matter. By bringing slack coal under the operation of the bill and imposing a royalty of ten cents a ton on it, it would make a difference to Londonderry mine in the furnace now going of many thousands of dollars a year. There were gentlemen on the committee who were aware that for the $3,000,000 expended by the Londonderry Company the shareholders had never received a penny of return. It takes two tons of slack coal to make one ton of coke, so that if the proposed royalty on slack coal is imposed it would amount to a tax of five cents a ton on coke, and this would be, as already shown, a very serious tax on the pig iron produced by the company. The rolling mill at present was carried on without loss, but also without profit. The imposition of the proposed tax would entail an absolute loss to the company. The company had been discussing the propriety of blowing in another furnace. If that were done the yearly loss would be still further increased. There never was a time when iron was as low as at present, and if the bill became law it would be a question whether the company could continue operations or not.

In answer to a question by Mr. Goudy, Mr. Poole explained that it was one of the express terms of the leases that coal "known as slack coal" should be free of royalty, and it was clearly a breach of covenant to require, as the Act did, that coal for the manufacture of coke should pay royalty, coke being almost entirely made from slack coal.

MR. G. E. FRANCKLYN (General Mining Association) concurred in what had been said. With regard to the bill providing for existing contracts, he thought, with an exception which he desired to point out, that it would meet the substantial requirements of justice. This spring he was in Montreal and made offers to the Canadian Pacific Railway Co. When he returned he found the notice of the proposed increase of royalty. The offer made the company, of course, could not be withdrawn. As the price of coal went down they had been obliged to accept a lower price. If they had not done so the company would have taken American coal and the province would have lost the whole of the royalty. As the contract was practically made before the reception of the notice, he thought that the coal, under the circumstances, should pay the old rate.

MR. H. A. BUDDEN, (Intercolonial Coal Co.) said that it was usual to commence negotiations for contracts early in January. He was engaged for from six weeks to two months in such negotiations before the actual closing of the contracts. Contracts had been made by his company amounting in all to 100,000 tons, of which a large portion went to the Canadian Pacific Railway. Contracts had to be made early in order to engage the tonnage required. Buyers could not be forced to definite terms. If one company did not meet their views another would.

MR. J. R. LITHGOW, (Glace Bay Mining Co).—While other companies holding leases prior to 1866 had the leases renewed, the Glace Bay Company did not take out renewals in 1866, but held the original lease, under which, in 1873, the company became entitled to renew on the terms of the original leases. According to that legislation they were only bound to pay six pence per ton, old currency, on round coal and have slack coal free. This being the case, it seemed like a breach of faith, when the time came to give the renewals, that they should not be able to obtain them. Suppose that in 1862 the Province issued debentures bearing interest at 6 per cent., to terminate in 1886; and suppose that in 1873 the Legislature enacted that the holders of those debentures should be entitled to renewals for periods of 20, 40 and 60 years at the same rate of interest. The consequence would be that the debentures would be increased in value. Suppose that ten years after the Legislature should enact that the holders of the debentures should have the renewals, but only at the rate of 4 per cent. That would look like repudiation, but it seemed to him to be a parallel case. Or suppose that he leased a property for a period of 20 years at a specified yearly rental, and the landlord said that he might have a renewal for a further period of 20 years at the same rate. Then suppose that when the time came to renew, the landlord said, "you may have your renewal, but you must pay an increased rental." That illustration was applicable to the present position of the holders of coal leases. They were entitled to renewals on the terms of the old leases, but the Legislature said, "You can have your renewals, but you must take the chance of what the royalty will be." He did not think that that was fair, and he did not think that it would be sanctioned.

MR. H. S. POOLE—The Province of Quebec found that money could be borrowed at four per cent., and proposed to substitute debentures bearing interest at that rate for the debentures upon which they were paying five per cent. The result was that they had not only to withdraw the bill, but the debentures of the province fell from par to 92.

MR. B. G. GRAY stated that he held three leases taken out under the statute which provided that the royalty was subject to revision and alteration. The legislation of 1885 changed those terms, and inserted a provision that the Legislature might increase or diminish the royalty. In interpreting this legislation, where the terms used were different, it would be held that the Legislature must have intended something different. If the first terms were equivalent to the last, the Legislature would not have found it necessary to make any change in them. He thought that the terms first used did not mean the same thing as the other. If the royalty could be increased in the way proposed, it could be increased every day in the week. He had contracts now current that had been made for six years. To "revise and alter" was a very different thing from to "increase and diminish." In order to encourage enterprise, the Legislature might have intended, under the first terms, to give power to remit royalties for a number of years.

MR. POOLE, read the following excerpt from a letter under date of 8th April, 1892, he had received from Messrs. F. H. Odiorne & Co., 86 State street, Boston :

"The parties (referring to certain Boston capitalists), have a bond only for the Inverness property, and they have written to the Halifax people that they shall not purchase, but will surrender their bond in case the Government raise the rate of royalty. There can be no question but that such action by your Government will prevent the investment of American money in your mines, and greatly injure the credit of your Government in all other matters. We shall be very glad if we can see any way in which we can aid you in this matter."

The following is the opinion of Drysdale Newcomb, and McInness, above referred to :—

35 BEDFORD ROW, HALIFAX,
April 6th, 1892.

DEAR SIR,—Referring to your conversation of yesterday with the writer, and to Mr. Clendenin's letter of the 28th ult., which we herewith return, we beg to say that it is our opinion, and we have no doubt that those words in your lease which provide "that the Legislature shall be at liberty to revise and alter the royalty imposed by these presents in or after the year 1886," refer only to the successive times for renewal, or possibly to some one particular time for renewal only, to be selected by the Legislature, and not to any time during the currency of the renewal terms. This construction appears to be very

clear, having regard to the context, and the all important fact that the year 1886 was the time for the first renewal. It is further the most reasonable construction with reference to the contract, and the rights with which it deals. It follows that the Government has not, as a matter of contract, the right to have at the present time a legislative revision of the royalty.

Yours truly,
(Signed) DRYSDALE, NEWCOMBE & MCINNES."

H. S. POOLE, ESQ.,
Agent Acadia Coal Co., Stellarton, N.S.

"I approve of and concur in the above opinion,
H. McD. HENRY."

Also concurred in by B. G. GRAY.

Finally the Hon. Dr. Parker drew attention to the section which required the extra royalty to be paid, as for February 23rd, to which Mr. Poole replied :—

That the lessees unhesitatingly regarded this section as retroactive ; they had sent in their quarterly returns at the end of March as required by previous legislation, and the section in question did not show how a correction was to be made.

Iron Smelting in Toronto—The Petition of the Ontario Iron and Steel Company.

The petition of the Ontario Iron and Steel Co., by their board of provisional directors, humbly sheweth :—

1. That a petition to your Government for the incorporation of a company to be called "The Ontario Iron and Steel Company, limited," under the Ontario Joint Stock Companies Patent Act, has been signed by the following gentlemen, viz.: Elias Rogers, H. S. Howland Robert Jaffray, A. S. Irving, S. H. Janes, H. N. Baird, J. K. Kerr, W. D. Matthews, John I. Davidson, H. L. Hime, T. D. Ledyard, provisional directors, and J. Kerr Fisken, W. I. Mackenzie, J. W. Langmuir, Wm. Ince, Samuel Beatty, A. M. Walton, E. W. Brown, John McAree, C.E., Clarence J. McCuaig, Joseph Blakely, W. M. Stark, Harton Walker, Lewis Lukes, Fred J. Stewart, W. Hope. Alex. Rankin, W. H. Howland, S. Shaw, J. Enoch Thompson, S. Frank Wilson, H. Wyatt, Robert Hodman, John T. Moore, James Baird, P. Lang James, C.E., A. C. Macdonell, Edward Moore, L. O. P. Genereaux, James McGee, J. L. Scarth, Scott & Walmsley, C. J. Smith, R. H. Bowes, P. G. Close, Robert Beatty, O. A Howland, C. S. Gzowski, jun., C. McMichael, C. Gordon Richardson ; W. A. Allan, Ottawa, Ont. ; Geo. A. Cox, John Leys, Herbert A. E. Kent, James Hedley, Horace Thorne.

2. That although it is believed that promising deposits of iron ore suitable to make pig iron and steel exist in the Province of Ontario, there is at present no mine producing iron ore in Ontario, and the extent or value of such deposits is as yet unknown, nor is there any blast furnace in operation in the Province.

3. That ores, apparently of excellent quality, have been found in Ontario, some of which, being exceptionally free from phosphorus and other impurities, are suited to make the finest steel, but further practical tests require to be made to prove their quality, quantity and extent.

4. Your petitioners humbly present that, in order to obtain sufficient capital to erect and operate a furnace, it is necessary to demonstrate beyond a doubt that iron ores suitable to make pig iron and steel can be mined at accessible points in Ontario in sufficient quantities to supply such furnace.

5. That capitalists are unwilling to assume the whole risk of pioneering this enterprise, which, like all experiments, is attended with a considerable degree of uncertainty ; therefore it will be necessary to obtain some financial aid from your Government to assist in the erection of such a furnace, and also a bonus upon the output thereof.

6. That foreign capitalists will not invest until it can be demonstrated that iron can be smelted profitably.

7. That a furnace erected in Ontario which will produce pig iron from our ores will be the most practical method of developing and utilising the mineral resources of our Province and of determining the value of the mineral lands still held by the Government, which will benefit in a greater degree from the success of the enterprise than any private individual.

8. That a company, intending to erect and operate a modern furnace capable of producing one hundred (100) tons of pig iron daily, will require a paid up capital of at least five hundred thousand dollars.

9. That the establishing of such a furnace will lead to other industries incident to the multifarious applications of iron, steel and nickel-steel, thus retaining in our Province an immense amount of money which is now expended in importing the products of iron from foreign countries, and furnishing employment for hundreds of thousands of artisans.

The extraordinary growth of the population of the United States, which is largely due to the development of mining industries, furnishes an illustration of the benefits which will accrue to Canada from the same source.

Your petitioners therefore pray :—

1. That the Government of Ontario should make a suitable appropriation through the Bureau of Mines to test and prove by diamond drill borings, or such other means as the Government may deem necessary, some of the most accessible deposits of iron ore in Ontario, showing their extent and value ; and such tests shall be made under such regulations and restrictions as the Government may deem expedient.

2. That an Act should be passed by the Legislative Assembly authorising the Government to give a bonus of two dollars ($2) per ton on the output of a modern furnace, which shall be of not less capacity than one hundred (100) tons per day, erected at such place in Ontario and under such conditions by such company as shall be approved of by the Government, such bonus to be given for ten years from the time such furnace shall commence to produce pig iron, and also to aid, in such other manner as your Government may deem expedient, any company which will undertake forthwith the erection and operation of a modern furnace to smelt Ontario ores.

In the event of such prayers being granted to the satisfaction of your petitioners, your petitioners propose immediately to complete the organization of said company and to proceed with the erection of a furnace capable of smelting 100 to 150 tons of pig iron daily.

It is claimed by the promoters of the project set forth above that the requisite ores can be found in great plenty within about 115 miles of Toronto ; and in a pamphlet recently issued on the subject, in which the undeveloped mineral centres in Ontario are discussed in detail, it is shown by the analysis of experts that the ores in almost every case are of unusually high grade, being particularly free from phosphorus and sulphur. The promoters have strong hopes that the time is not remote when a blast furnace will be established in Toronto and a vastly increased product of Ontario ores smelted right here. The Belmont Bessemer Ore Co., of New York, which last year leased the Belmont iron mine, about 110 miles east of Toronto, are building a railway nine miles long from the mine to the Central Ontario Railway, and state that as soon as this piece of road is completed, which will be during the summer, they intend to put on a force of 500 men at the mine and make large shipments of ore. A deputation will shortly wait on the Government and present fully the views of the promoters.

Nickel-Steel.

This alloy was first described in a paper read by Mr. J. Riley before the Iron and Steel Institute. Since then the alloy has assumed great importance, owing to the results obtained in the armour-plate tests at Annapolis. In these tests nickel-steel was shown to be superior to ordinary steel for armour-plates, and also to compound armour. Mr. Garrison observes that the United States authorities appear to have considered these results as conclusive and final, and adopted at once nickel-steel as the sole material for the armour-plates of the new United States navy. This, the author adds, appears a questionable and short-sighted policy, in view of some of the remarkable results which have been obtained with other and cheaper steel alloys.

The author next refers to the method of manufacture patented by the Creusot Works in 1889, which consisted in the fusion of nickel scrap and pig iron in a reverbaratory furnace under a layer of anthracite, for the purpose of avoiding oxidation. The resulting metal is used as an addition to metal poor in nickel.

What is known as "Marbeau's nickelo-spiegel" is made by a process which consists in the simultaneous reduction of the ores of nickel, iron and manganese. According to Riley, nickel-steel can be made in any good open-hearth furnace working at a fairly good heat, and no special arrangements are required for casting. If the charge is properly worked, scarcely any of the nickel will pass into the slag. No particular care either is required when reheating the ingots for hammering or rolling. If the steel has been well made, and it is of proper composition, it will hammer or roll well whether it contains little or much nickel.

Steels rich in nickel are practically non-corrodible, and those poor in nickel are much better than other steels in this respect, the whole series of steels, up to 50 per cent. of nickel, taking, according to Riley, a good polish and finish. The alloys up to 5 per cent. of nickel may be machined with moderate ease ; beyond that percentage they are more difficult to work. Mr. J. F. Hall has stated that he has made nickel-steel with a tensile strength of 97 tons per square inch, and with an elongation of 7 per cent., and Mr. G. J. Snelus has pointed out that some samples of nickel-steel appear to extend uniformly over their whole length, in the manner, that is, of the manganese steel, to which reference has already been made. Some of the nickel steel recently made by Messrs. Carnegie, Phipps & Co. for the United States Navy department gave the following results :—

	I.	II.
Elastic limit, lbs. per square inch....	59,000	60,000
Ultimate tensile strength, lbs. per square inch.....	100,000	102,000
Elongation, per cent	15·5	15·5
Reduction of area, per cent.....	29·5	26·5

The test-pieces were cut from ¾ inch plate, and the metal contained 0·2 per cent of nickel.

Howe states that the hardness of nickel-steel depends on the proportion of nickel and carbon jointly, nickel increasing the hardness up to a certain percentage, and the hardness again diminishing as this percentage of nickel is exceeded. Steel containing 0·9 per cent. of carbon and 2 per cent. of nickel cannot be machined. The metal forges easily whether it contains little or much manganese. The presence of manganese in nickel-steel is most important if the conditions of treatment are to be successful. Salt water does not corrode nickel-steel as readily as ordinary steel. At very low temperatures nickel-steel shows considerable expansion.

The electro-conductivity of nickel-steel is very low, the resistence being very high. Hopkinson has shown that nickel-steel containing less than 5 per cent. of nickel is decidedly more magnetisable than wrought iron, particularly for high inductions. On the other hand, when containing 25 per cent. of nickel, it is non-magnetic at ordinary temperatures; but if cooled to 20° C., it becomes strongly magnetic, and remains so, when it again returns to normal temperature. If, finally, it is heated until it reaches its critical temperature, 580° C., it becomes again non-magnetic, and remains so until cooled once again to the temperature above mentioned,—20° C.

Mr. Garrison next proceeds to a consideration of the results obtained with the trials of armour-plates both at Annapolis, United States, and at Ochta, near St Petersburgh. A reproduction is given of a photograph of the plates used at Annapolis, and taken after the trial. The great advantage of the nickel-steel plate over the ordinary steel plate, lay in its absolute freedom from cracks, though it showed slightly less resistance to penetration.

Canadian Platinum.

BY J. T. DONALD, M.A.

Under this title the writer read a paper before the meeting of the General Mining Association of the Province of Quebec, in January last. This paper was published in the REVIEW and reproduced in *The Engineering and Mining Journal*. Owing to the wide publicity thus given to it the writer has received further information on the subject, the most interesting portion of which refers to sperrylite, the platinum mineral of the Sudbury district.

In the paper above referred to it was stated that "So far as can be learned no effort has yet been made to utilize sperrylite as a source of platinum." It now appears that this mineral has been used as a source of commercial platinum. Mr. Charles F. Croselmere, of Newark, N.J., writes me that last year Messrs. Eimer & Amend, of New York, furnished him with a quantity of sperrylite, and that he extracted the platinum from it and returned it to them in the form of wire.

It would thus appear that should sperrylite be found in sufficient quantity its contained arsenic will not be a barrier to its use as a source of platinum.

The Practical Working of Coal Cutting Machines.

At the last meeting of the Manchester Geological Society, Mr. Richard Sutcliffe read a paper on the "Practical Working of Coal Cutting Machines," in the course of which he said that he quite agreed with Mr. Walker, of the Wharncliffe Silkstone Colliery, who was the largest user of coal cutting machines in England, when he said that actual experience points to 100 yards per 8 hours shift as being a satisfactory performance with coal cutting machines when the ordinary conditions of work in a coal face were in force. The writer had found that the most convenient machine, and a better one for all round work than any, was one having a cylinder at each end, with the cutting wheel in or near the middle. By this arrangement a comparatively light machine would keep the rails without extra fittings in working, and was capable of cutting either coal or fire clay, and the power could be varied to suit the material to be cut, by making it to run from 3 to 1, to 12 to 1 between the crank shaft and cutting disc, and its total length need not exceed 7 feet. To get anything like good results from the best machines, when cutting 3 feet deep or more, the debris should be kept removed, as the fore or cutting portion of the wheel brought it from the groove or cut, otherwise it would be taken back in part by the back portion of the wheel, until it becomes jammed. As the attendant might have many things to look after, as well as the removal of this debris, it was often neglected, and therefore much of the power wasted. This fact must suggest to the contemplative mind the desirability of making a coal cutting machine capable of dealing with its refuse automatically so as to prevent its return into the groove. The fixing of the chisels or cutters in the periphery of the rotating disc had a great influence on the working of a machine in cutting hard material. The proper way was to fix the cutters radial in the disc and hook them near their edges sufficiently forward to cut, and then as a cutter shank wore loose it got less instead of more work to do. Even the sharpening of the cutters had an important effect on the working of a machine, and a set of 20 was sometimes blunted in as low as 10 yards, and sometimes would cut as much as 1000 yards, even when properly edged and tempered, according to the material to be cut. If the holing was fairly free foom iron pyrites, or such like impurities, the set of cutters should do from 50 to 100 when each cutter was doing its share in either coal or fireclay. A good coal cutting machine should be strong and simple in construction, with few working parts, it should have sufficient base and weight to keep on the rails when working it without extra fittings, it should be able to cut either way, and be easily reversed, and should automatically remove the debris so as to prevent it getting into the groove, and it should not exceed 3 feet in width nor 7 feet in length. Where coal had to be blown down after being cut it was best to make a deep holing, but when it fell from gravitation, it was sometimes advisable to take a lighter or shallow cut which enabled the machine to cut a greater distance, and the fillers to fill out a greater leagth, each in the shaft, allowing the gates to be farther apart, but whether the cuts where deep or shallow it was undesirable to dress

down the face more than was necessary to the machine to pass, as it saved labour, and made less small when allowed to remain for next fall.

At Gartness Colliery, near Airdrie, in Scotland, where machines had worked successfully for many years, in a 30 inch seam, with good roof and strong floor, they made the gates 14 yards apart. The corves were filled in the gate at about 8½d. per ton, and the filler had to throw the coal when it got out of his reach, filling 6 yards at each side of the gate. The cutting was done by one contractor at 4½d. per ton, and the filling was done by another. In Yorkshire the system was to take the corves into and along the face, necessitating the use of small corves in thin seams, but allowing the gates to be made at any desired distance apart, and accordingly they were made at from 12 to 50 yards apart, to suit the ideas of those adopting them, and it often took from two shifts upwards to fill out the coal. This necessitated irregular working of the machine, without any regular quantity of work being laid out for them per shift, and it was not nearly so methodical a system as the Scotch. It also compelled the filler to take up the spavin instead of confining his energy to the filling out of the coal, which could not very well be done, but while the pit was drawing, and the spavin could be removed at any time. In some cases the machines were made to cut all in one direction, having to be taken back through the gateways, every time it cut through the length of the face, but almost all the recent installations were made to cut back and forward. His (the writer's) opinion was that money spent in taking them through the gates, except for repairs, was simply wasted. The best mode of working seemed to be to subdivide the labour into something like the following divisions:—Holers, blowers, and timberers, and fillers, packers and rippers. The holers would include a man to drive the machine, one man to lay the way in front of the machine, and a youth to clear away the debris from the cut; the fillers, to devote the whole of their time in filling out the coal. The blowers would include men to bore the holes, timber up the face and blow down the coal. The packers to take up the spavin and rip and pack the gates. The whole of those about the machine should be under the control of a capable man (more especially at the commencement) who understood machinery and mining in a general way. He might have it on contract, so it could be left to the section under him, but he should have complete control of the men, without interference of subordinate officials, whose prejudices and jealousies would only hamper and impede the work. Energy, perseverance, and system would work machines in any mines, with a fairly good top, but, of course, their proper place was in thin seams, where holing forms the greatest part of the labour, and where properly worked they should benefit both the miner and the mine owner; the former, in doing the most laborious part of the work, and the latter by increasing the output, reducing cost of getting and in reducing the proportions of slack made in getting. Mr. G. B. Walker gives the saving effected in the reduction of cost of getting, at from 3d. per ton in a 3 feet seam to 10½d. in an 18 inch seam, and that effected by the value of the yield of coal as compared with hand labour, at from 6·7d. in the 3 feet, to 10½d. in the seam 18 inches thick, per ton, making together a total saving of from 9·7d. in the 3 feet, to 1s. 9d. per ton in the 18 inches seams. In concluding his paper, Mr. Sutcliffe said that the boring type of machine had obtained a strong footing in America, but compressed air was the motive power in both countries, with few exceptions, and in the mining districts of the United States, machine mining was steadily increasing, there being scarcely any coal-producing territory of the Union where machines were not being, or had not been, used with more or less success.

Buckingham and Lievre Railway Company's Bill.

(Proceedings in the Senate.)

Hon. Mr. DICKEY, from the Committee on Railways, Telegraphs and Harbours, reported Bill (H) "An Act to incorporate the Buckingham and Lievre Railway Company," with certain amendments. He said: The first amendment to this bill is in the clause which states the direction which this road is to run. By the Bill, as it came to us, it was required to pass along the River Lievre, and as the railway projectors did not desire to make it quite so crooked as that river, they asked to amend the Bill by putting in the words "along or near the river." To such an amendment, I presume, there will be no objection. The next amendment is that which introduced the provision that this work shall be declared a work for the general advantage of Canada. The next amendment is to introduce the word "connects" in the clause which gives authority to make agreements with other lines. These are the amendments, with the exception of the concluding clause in the report which it is my duty also to explain to the House. This charter, as applied for, is for the construction of a line of railway from Buckingham up the Lievre River to its source, and also to continue that undertaking south from Buckingham to the River Ottawa, and to cross the River Ottawa by a bridge, and then to connect with other lines through the Province of Ontario. The House is probably aware that by our 66th rule, it becomes the duty of the committee to whom a private Bill is referred to report whether there is any difference between the Bill as it was brought before them, and the Bill which was originally applied for by petition and notice given. In this case all the provisions which give authority by this Bill to construct a line from Buckingham to the River Ottawa, and a bridge across the Ottawa, and the connecting lines from that bridge to other railway lines in Ontario, were left out of the notice. No notice was given of them, and it became our duty to report that fact to the House, so that the House might deal with it as they chose. In connection with that a question was asked by the hon. gentleman from Sarnia as to whether the notices were regular in other respects, as to time, and I felt it my duty to look into that, and I have now in my hand the report of the Committee on Standing Orders and Private Bills, to which committee this Bill had been referred, in which they state that the notices were short in point of time, but recommend the suspension of the rule, and the rule was accordingly suspended. But the fact that the notice was short I felt bound to state to the House. It is for the House to determine whether they will pass this Bill now, or take it into consideration at a future day. My duty is discharged when I state the nature of the amendments.

Hon. Mr. CLEMOW moved that the amendments be concurred in. He said: The chairman has given a fair explanation of all the changes that have been made and I do not think they interfere with the Bill in any respect. It is true what he says, that there was no notice given of this bridge and connection, but it does not affect anyone. It is rather an improvement in the Bill as it was originally introduced. The motion was agreed to and the amendments were concurred in.

Hon. Mr. CLEMOW moved the third reading of the Bill as amended.

The motion wae agreed to and the Bill was read the third time and passed.

Alberta Railway and Coal Company's Bill.

(Proceedings in the Senate).

Hon. Mr. GIRARD moved the second reading of Bill (39), "An Act respecting the Alberta Railway and Coal Company." He said: The company asked for power to further extend their railway through the Crow's Nest Pass to a point where a connection may be conveniently made with the Canadian Pacific Railway. They also ask for authority to construct, maintain and operate irrigation ditches in the District of Alberta. Of course they ask for power to impose certain charges for the use of these irrigation ditches, but these charges must be submitted to and approved by the Governor-in-Council. The work referred to must be commenced within three years and completed in six years, and in the case of irrigation works the limit is seven years.

The motion was agreed to and the Bill was read the second time.

MINING NOTES.

[From Our Own Correspondents.]

Nova Scotia.

Cumberland County.

The coal sales of the county were 462,267 tons, for 1891, against 438,608 tons in 1890.

The production of the collieries of the Cumberland Railway and Coal Company was 459,395 against 419,012 tons in 1890, in spite of the delay caused by the explosion. Since that date the enlargement and completion of the air-way has been finished. New pumps, screens, etc., have been put in, and the colliery generally placed in excellent order. Safety lamps alone are used underground, and no explosives.

There has been quite a lot of work done in the air-ways and the volume of air considerably increased. The new lift which was sunk last year in the east slope has been opened up this year, and levels driven east and west. During the year the west slope has been sunk down 1,200 feet. There is also a new lift in the north slope and one in the east slope, 600 feet each, and 1,200 feet in the west. Properly speaking, we do not know the extent this lift may be driven westwardly, as every year further developments are made of this seam westerly, until now they are proven for some miles with slight variations southerly, caused by up-throw dikes or faults. Easterly the No. 5 slope is proved to some extent a distance of one mile, roughly speaking.

There are somewhere about 1,400 men and boys employed in these mines, and when we take into consideration the hazardous nature of their employment the casualties that do occur are comparatively few. During the year there has been placed in the north slope a new duplex pump—high and low pressure, water barrel 10 inches, stroke 36 inches, water column 10½ inches; the pipes are lined inside with wood.

The Chignecto mine has remained closed, and no returns of a satisfactory character have been received of the results of the prospecting carried on for other seams.

The output from the Joggins mines was 60,056 tons.

Pictou County.

The coal sales in 1891 amounted to 405,096 tons, as compared with 430,509 tons in 1890. The home sales were 265,098 tons against 277,753 tons in 1890.

Gay's River.

"The gold district of Gay's River," writes Mr. Faribault, "was re-opened last spring by the Coldstream Gold Mining Company, who put up an extensive 50 stamp steam mill and other large buildings. They sank a shaft, immediately north of Daniel McDonald's old works, which gave the following section of the Lower Carboniferous:

	Feet.
Surface drift	20
Conglomerate containing gypsum, non-auriferous	35
Coarse sandstone	2
Auriferous, irregular conglomerate	8

"This lower auriferous conglomerate is wholly composed of debris of the adjacent Lower Cambrian rocks, apparently in an old river bed, and rests on the lower graphitic ferruginous slate group. Beds of conglomerate similarly situated along the northern boundary of the gold-bearing rocks may prove sufficiently rich to be worked, but the great excitement caused two years ago by exaggerated reports of discoveries of gold in various places, remote from the gold-bearing rocks, have led a great many to take up valueless ground."

Oldham.

Mr. E. Faribault, in his preliminary report of the operations of the Geological Survey in this district, writes as follows:

"Special attention was given to the gold district of Oldham, it being a typical district, worked to a great extent and exposing to great advantage the quartz leads, all of which were prospected by means of surface trenches on account of the small thickness of the drift. A detailed geological map of this district, on a scale of 500 feet to one inch, with sections, was compiled on the ground. It shows the elliptical structure of the anticlinal fold, with all the known quartz veins, both interbedded and transverse; and also the numerous faults affecting them, and proves clearly that the richness of a lead depends altogether on its position and relation to the structure of the elliptical dome of the fold to which it owes its origin. In this work I am specially indebted to Mr. J. E. Hardman, B.Sc., M.E., manager of gold-mining properties in Oldham and Waverley, for much valuable information which his great exprience in gold-mining enabled him to give.

"Some facts which have an important bearing upon the question of deep mining may here be introduced in view of the great interest taken at present by the mining community in the subject. From a study of the districts east of Halifax, and especially of that of Oldham, it is plain that whenever an interbedded lead is followed some distance on the surface or to great depths, its relation to the axis of the anticlinal, and consequently to the stratigraphy of the fold, is constantly changing, and its size and workable value must consequently be affected; so that it is improbable that a lead found rich and of good size on the surface can be followed profitably to great depths. The limit of depth may vary from a few feet to 400 or 800 feet, according to the structure of the anticlinal fold. In most of the districts the zone of rich leads has the anticlinal axis for its centre, and it is probably the centre of the auriferous zone to a depth practically unlimited. Such is the case in the eastern part of the province, at Seal Harbour, Isaac's Harbour, Goldenville, Harrigan Cove, Salmon River, Fifteen Mile Stream, Killag, Mooseland, Moose River, Caribou, Gold River, Lawrencetown, Waverley and Oldham. In a few other districts where the auriferous zone is worked only on the north or south side of the anticlinal, the zone would, for the same reason, be parallel to the axis of the anticlinal to an inaccessible depth, as in Isaac's Harbour, Wine Harbour, Beaver Dam, Tangier and Lake Catcha.

"I would, therefore, strongly recommend that deep, perpendicular shafts be sunk on the anticlinals, and that cross-cuts be driven on both sides at various depths to test leads which do not crop out to the surface, many of which would probably prove very rich, as they would be cut in their most favourable stratigraphical position and could easily be worked by means of levels and overhead stoping from cross-cuts and the one perpendicular shaft. This system might be adopted with advantage at the North Star property of Isaac's Harbour, at Goldenville, where both sides of the anticlinal have been worked from 500 to 600 feet deep and abandoned, but the middle of the auriferous zone has never been tried; at Fifteen Mile Stream, in the vicinity of the Serpent lead; at Moose River, where Mr. D. Touquoy has his main shaft; at Waverley, on the east and west side; and at Oldham, west of the Black Brook. No such systematic workings have, however, yet been undertaken in Nova Scotia that I know of, except in Oldham, where Mr. J. E. Hardman began last summer to sink a perpendicular shaft on the anticlinal dome. The result of his undertaking is awaited with great interest.

"The pay streak of the leads in different districts is also of great importance to miners; but, unfortunately, the data necessary to draw conclusions are very meagre, as in most of the mines, especially in old workings, no systematic records of the yields of different parts of the leads have been kept. I hope, however, to be able to throw some light on the subject from the notes I have gathered this summer."

The vertical shaft of the Napier Mining Company has reached a depth of 116 feet. A plat has been made at 100 feet, and a large station is now being cut, preparatory to driving the cross-cuts. The annual meeting of the company was held on the 19th May, when Mr. J. E. Hardman was re-elected manager. This company is doing the most important prospecting work that has ever yet been attempted in the Province.

The mines of the Standard Gold Co. are reported in good rock, the bulk of the milling rock coming from the 450 foot level. The company is opening up some lodes on the eastern end of its property which promise well.

The Oldham Gold Co. commenced work on the Old Dunbrack lode this month for the first time since the judicial sale of the property in 1890. The 150 ft. level west, is being driven by contractors, and the western stopes of No. 3 shaft are working. As soon as men can be obtained the eastern stopes will also be started. The Baker mine of this company shows no improvement, and is being operated at a loss.

Waverley District.

During May the mill of the West Waverley Gold Co. has been running continuously and has made some remarkable records for Nova Scotia. The largest record made in the month was 80 tons crushed in 60 hours, an average of 32 tons in 24 hours, or (as this mill has only 10 stamps), $3\frac{2}{10}$ tons per stamp per diem. The screens used were Russia iron, indented slot, No. 7 needle, or about 35 mesh. The stamps weigh 860 lbs., and drop $6\frac{1}{2}$ inches one hundred times per minute. The yield of gold is small, averaging about 7 dwts. for April. The capacity of the ten stamps is given at 600 tons per month.

This company is also making a fuel record which is noteworthy for this country. The total consumption of coal for the month (under two boilers) running the hoisting engine, mine pump, three air drills, a tank pump and the ten stamp mill with accessories, was a daily average of $1\frac{8}{10}$ tons of bituminous coal for 24 hours. The original estimate was two tons per diem. When the company has perfected its water supply so that the large engines can be run, condensing, a still further economy, can be looked for.

The Lake View company has closed down indefinitely, and the main shaft is now filling with water.

The tunnel under Laidlaw Hill in East Waverley is being driven by contract. A small boiler and engine have been placed at the mouth of the tunnel to force in air for ventilation. The length is now close on to 500 feet. As before noted, this tunnel is being driven for the purpose of cutting the famous Barrel lode at a depth of over 100 feet.

Goldenville.

The community here were startled about the 1st of May to learn that a dastardly attempt had been made to blow up the engine and boiler of the Sutherland Mining Co. Some months ago there was a difference between the company (which is an American concern), and a person in Goldenville, which difference was finally taken into court to be settled. Judgment was in favor of the company, and the day after judgment was given, the engine of the defendants was found blown to fragments with dynamite, and an unexploded cartridge of dynamite with fuse attached, was found in the boiler. The works had been idle for some time, and the boiler was empty of water.

The Gold Miner's Association have taken up the matter and will ask the Government to offer a reward for the detection of the offender. Nova Scotia has hitherto been known as a peaceful and law abiding country, but a repetition of this dynamiting work will change its reputation very quickly.

Darr's Hill.

The Dufferin mine reports a scarcity of men, owing to the opening of the lobster season. Nothing new in the mine developments is reported. It is rumored that the mine has been bonded for a sale.

Isaac's Harbor.

Nothing is doing here in mining. The sale of the North Star company's property, in April, is understood to have been in the nature of a re-organization of the company. The president of the company states that work at the mine will probably be resumed in June, and that the company will erect a small stamp mill on the property. Formerly the quartz produced was crushed at the Rockland mill on the opposite side of the harbor.

The Harbor Commissioners, under ruling of the court, have forbidden the Rockland mill to discharge its tailings into the harbor, and the mill in consequence has been forced to close. This action will prevent the working of the prospect in the Skunk's Den, as the mill is the only one in the district.

Montagu District.

Mr. Charles Annand sailed on the *Labrador* this month for England, taking with him two large boxes of magnificent specimens. It is hoped that his arrival will speedily consummate the purchase of the Montagu properties by the English syndicate. These properties now include the New Albion, the Montreal, and the Kaye-Simonds. Mr. L. J. Boyd has been busily engaged in mapping the Kaye-Simonds on the same scale as the maps of the other properties, and this new map has been sent forward.

Killag District.

Mr. D. S. Turnbull has taken charge of the property of the Old Provincial Company, which is the name of the concern which acquired the property of Mr. G. W. Stuart *et al.* The shaft has been timbered, the engine bed laid, and the pit for battery formations excavated. A saw mill has been erected on the property, and the work of construction is rapidly going forward. The shaft will come up in one corner of the mill building, the cage landing its car on the topmost floor, whence the rock will be trammed to the mullock heap, and the quartz will be dumped into bins. The mill is to have 10 stamps.

Country Harbor.

The Copeland mine at Johnson's Brook, is reported to be doing well.

Mr. Robt. McNaughton has built a 20 stamp mill here but has not yet started it. His quartz is reported to be of lower grade than the Copeland.

The experience of this district in 1886 and 1887 should be remembered, and its transitory character kept in mind by those owning property there. It is always better to creep before one walks in matters of mining.

In General.

We are indebted to the thoughtful courtesy of Mr. E. R. Faribault, of the Geological Survey of Canada, for a fine set of photographs taken in some of the prominent gold mining districts of Nova Scotia. In one of these we have an excellent illustration of the occurrence of the famous barrel-quartz from the Dunbrack lode at Oldham.

The first quarterly general meeting of the Mining Society of Nova Scotia takes place at Halifax on 17th prox. An interesting programme is arranged. We trust there will be a very full attendance at this meeting.

New Brunswick.

The recent and stratified deposits of Westmoreland and Albert Counties are varied and interesting, and those of tidal origin, viz., the salt marshes, are unique. "These marshes," writes Mr. R. Chalmers of the Survey, "comprise, in Westmoreland and Albert Counties alone, an area of 35,000 acres, and have long been noted for their fertility. Of late years, however, they have deteriorated. This remark applies more especially to those portions which have been dyked and cropped continuously for a century or more, without the application of any fertilizing material to the soil, which has, in consequence, become deficient in plant-food. Lime and wood ashes have been recommended; but improving them in this way is slow and expensive. A scheme inaugurated by the more intelligent farmers of Sackville would, if systematically carried out, be more effective and economical, viz., the cutting away of portions of the dykes and aboideaux and flooding the marshes with the tidal waters of the Tantramar and other rivers, which flow through them. The tides, which rise high enough to overflow these marshes, if the dykes were broken, carry in red mud and deposit it on their surface. This is an admirable fertilizer, its efficiency having been abundantly proved by the experience of the Sackville farmers. This system of improving them will probably be adopted by all the owners of exhausted marsh lands around the Bay of Fundy. It seems the natural method of restoring them, partially at least, to their original fertility. The depth of the marsh mud is variable, but increases seaward. Immediately underlying it is a layer of fossiliferous blue clay, which rests on a peat or forest bed. At Aulac, Intercolonial Railway, the latter attains a thickness of 20 feet and is overlain by 80 feet of marsh mud. These marsh and peat beds indicate, therefore, a subsidence of the land here within the recent period of about 80 feet. Intelligent observers inform me that the peat or forest bed is continuous or nearly so, throughout, underlying the salt marshes everywhere.

"Bog-manganese occurs in Albert County, near the Dawson settlement. On a branch of Meldona Creek an extensive bed of it has been opened up, and a branch of the Albert Railway constructed to it. Kilns for drying the materials have also been erected. This deposit covers about 25 acres of ground, and appears to be quite thick —in one opening the thickness being 26 feet. The ore is a loose amorphous mass, which can readily be shovelled up, and contains, in layers and patches, a considerable percentage of bog-iron ore, or red ochre. Indeed, very little of the material appears to be wholly free from iron, though large portions have merely a trace of it. The deposit lies at the foot of a hill, and its accumulation there appears to be due to springs. These are still running down the hillside, and, doubtless, the process of producing bog-manganese is still going on. Operations have temporarily ceased at this mine. Indications of other and similar beds of bog-manganese have been met with at the base of this hill further west.

"Bog-iron ore was found on the south side of Buctouche Harbour, Kent County, occupying an area of several acres. Where openings were made in two places, the deposit showed a thickness of from 12 to 15 inches.

"Just south of Richibucto Head another deposit of this material was observed, but its extent and thickness was not ascertained. Bog-iron ore was also noticed on the south side of the mouth of Kouchibouguac River by Mr. Wilson, and in a number of other places. No use has yet been made of it."

Quebec.

Eastern Townships.

Mr. A. P. Low, of the Geological Survey, in his preliminary report, gives some interesting particulars of the resources of that portion of the Townships comprising the southern portions of the Counties of Champlain and Portneuf. He says:

"At Lac Tortue the Canada Iron Furnace Company has lowered the water of the lake some four feet, and as the lake is very shallow with slightly sloping banks, a large area is laid bare around its edge, and here the bog-iron ore which has formed in the lake as flat concretions is washed out of the surface mud with hand seives, while the ore in the deeper part of the lake is raised by a dredge which carries three rows of buckets on an endless belt.

"Apart from Lac Tortue, in all the flat country about Three Rivers on both sides of the St. Lawrence, bog-iron ore is found in patches which vary from three to eighteen inches in thickness. The ore is gathered by the farmers from their lands, and brought in and sold at the furnace. As iron smelting has been in operation about Three Rivers since 1737 the supply of ore in the vicinity is somewhat exhausted, but new supplies of great extent have been found about Gentilly, opposite Three Rivers, and along the Joliette branch of the Canadian Pacific Railway, so that enough ore will be forthcoming to run the new furnace at Radnor which will have a capacity of thirty to fifty tons a day, smelting magnetite from St. Jerome along with the bog ore.

"Ochre is a common mineral in this part of the province and is at present worked in two localities, at St. Malo, eight miles from Three Rivers, and at St. Tite Junction on the Piles Branch Railway. At St. Malo the deposit has been proven across twenty-two lots and in width from 100 to 300 yards, with a depth from one to twenty feet. At St. Tite Junction the ochre occurs in two gulleys which join and run into the St. Maurice; the ore has been proven along both gulleys for nearly half a mile and has everywhere a considerable thickness. The St. Maurice Metallic Paint Co. and Johnson Paint Co. have furnaces for burning the ore at St. Malo, the former grinding the burnt material at Cap Magdeleine, near Three Rivers, the latter at Montreal. At St. Tite Junction a furnace and grinding mill are in course of erection by the Radnor Paint Co."

Templeton District.

Watters & Co. have commenced operations on their recently acquired Haycock mica property. It is claimed that the output is from three to four tons per day.

The East Templeton District Phosphate Syndicate is working eighty-five men at last report, and purpose putting on thirty more.

McLaurin & Sons have only a small force employed putting their property in order.

Lievres River District.

The Anglo-Continental Guano Company has struck a fine lead of phosphate in the Crystal Pit of the Aetna mine, 105 feet from surface. It is found in N. E. drift, also in S. E. drift, and going down in sump; the management is now sinking in this promising exposure. Both mines are now in fine shape, while the works and arrangement of plant reflects great credit on the company's engineer, Mr. J. B. Smith.

Mr. R. H. Jones, author of the well-known work on asbestos, has come out from London to take a position as accountant to the General Phosphate Corporation.

The Lake Terror mica mine, situated on lot 13, in the 3rd Range, Portland West, has produced and shipped to date, 47 boxes of clouded mica, of an average weight of 250 lbs. each.

Wakefield.

Smith & Lacy, of Sydenham, Ont., who purchased the Grace mica property at Gracefield, in this township, have a force at work. The outlook for a good and steady output is good.

The Gemmill mine continues to produce mica and phosphate steadily. Since last fall about 85 tons of mica have been mined.

Ontario.

Port Arthur District.

Many of the silver prospects which, owing to water, have been idle all winter, are about to be opened up again. At present rather more activity than usual is noticeable.

The few amendments to the Mining Act, made during the last hours of the Ontario Legislature, are a step in the right direction and give satisfaction. People hereabouts are in hope that some of the capital which was seeking investment at the time of the introduction of the Bill may still find its way into the district.

The Port Arthur, Duluth & Western Railway, it is

AN ORDINARY

QUARTERLY GENERAL MEETING

OF THE

GENERAL MINING ASSOCIATION

OF THE PROVINCE OF QUEBEC

WILL BE HELD IN

THE ASBESTOS CLUB HOUSE,

BLACK LAKE, QUE.,

ON TUESDAY, 14th JUNE, 1892,

COMMENCING AT HALF-PAST FIVE O'CLOCK IN THE AFTERNOON.

For the convenience of members and their friends attending this meeting a special car will be attached to the ordinary train (Quebec Central Railroad), leaving Sherbrooke, Que., at 8 a.m. on the morning of Tuesday 14th June. Black Lake members will join the party at 10.42 a.m. Train will arrive at Thetford Mines at 10.45 a.m., where some time will be spent in a visit to the Asbestos mines. Lunch will be served at half-past twelve o'clock (noon). Party will leave Thetford Mines at 1.30 p.m., returning to Black Lake by teams kindly furnished by the local Committee.

The ORDINARY QUARTERLY GENERAL MEETING for the reading and discussion of papers, etc., will be held in the

Asbestos Club House, Black Lake,

commencing at 5.30 p.m. Papers will be read by Mr. J. Burley Smith, M.E., Glen Almond, Que., and by Mr. L. A. Klein, M.E., Black Lake. At 7.30 members will be entertained to a dinner given in their honor by the Asbestos mine-owners and mine managers. Train will leave at 1 o'clock a.m. Wednesday, 14th inst., for Sherbrooke, where connection will be made for Montreal and points west. Tickets, $5.50 for the round trip (from Sherbrooke to Thetford and return) may be obtained from the undersigned, or from Mr. A. W. Stevenson, C.A., Treasurer, 17 St. John Street, Montreal.

GEORGE IRVINE, *President.*

B. T. A. BELL, *Secretary.*

reported, has made arrangements with an American syndicate for connections across the border in Cook county, Minnesota. Doubtless before long some of their iron ores will be transhipped into our carriers at Port Arthur.

Much interest is taken here in that portion of the Summary report of the Geological Survey, just issued, having reference to the examination of the region west of Port Arthur.

Mr. Smith discovered excellent indications of a broad zone of magnetic iron ore on the west side of a lake on the Big Turtle river, called "The Lake where the River Bends." The ore is associated and interbanded with micaceous schists. The bands vary from fractions of an inch to three feet or more in thickness, and this interbanded occurrence of ore and schist in its broadest development appears to be from 150 to 200 feet wide. To the south-east, near the southern end of the lake, this band appears to be cut off by a fault, and from this fault northward the iron ore could not be traced for more than a mile and a-half, the rocks being so thickly covered with vegetable mould that exploration in this direction was difficult and uncertain. The rocks here strike north-west and south-east, and dip from 45° to 55° to the south-west. They are very evenly stratiform in appearance and seem to constitute a tapering band trending eastward, then south-eastward from the broad band of Keewatin schists so largely developed in Manitou and Little Wabigoon lakes, and from certain ferruginous angular fragments found in the north-eastern arm of Manitou lake, Mr. Smith is inclined to think that more ores may be found in this vicinity, in the same geological horizon as the above, in the near neighborhood of the granites. An analysis of these ores made by Mr. G. C. Hoffman, chemist to this department, shows them to be very siliceous, yielding 40·17 per cent. metallic iron and 37.21 per cent. of insoluble matter, but no titanic acid. The ore is in such a position as to be easily mined, and considerable water-power is afforded at the outlet and inlet of the Big Turtle river. Unless the ore is found, as usual in this country, to be much richer in the actual ore bodies than in the surface indications, it will of course be of no commercial value in competition with the rich ores of the Lake Superior district on both sides of the international boundary.

According to reports the silver lead ores just east of Port Arthur contain an unusual amount of gold, no less than $43 to the ton being given. Mining machinery is going in and extensive operations are looked for.

A vein of copper has likewise been discovered in the same neighborhood.

Some nickel locations have been surveyed east of Schrieber, where the conditions are similar to the famous Sudbury region.

In General.

Reports reach us of a well directed movement to organize a company to manufacture iron in the city of Toronto. Preliminary meetings have been held and the whole ground carefully gone over and discussed. Among the promoters are Elias Rogers, Robert Jaffray, J. K. Kerr, S. H. Janes, John J. Davidson and H. N. Baird, of Toronto. At present a bounty of $2 per ton is paid on all iron manufactured in Canada, but to be entitled to it everythiug used in the manufacture must be Canadian. Now, smelting works to be successful in Toronto must use Pennsylvania coke, which is capable, so the firms interested in it declare, of producing a ton of iron for every ton of coke consumed. What is to be asked of the Dominion Government, then, is to pay the bounty of $2 per ton, and yet allow the use of American coke. A first-class ore can be had from the well known deposits at Belmont and Haliburton, in Peterborough County. The estimated cost of mining either of these ores is placed at $1.25 per ton, while the freight to Toronto, a distance of 110 miles, should not exceed 75 cents. If a furnace company in Toronto owned the mines in fee simple, it should be able to lay down ore at works for $2 per ton; if leased on royalty certainly not more than $2.40 at the furnace. It is calculated that, on the basis of coke costing $4.50, with both the magnetic and hematite ores costing $3.50 at furnace, there should be at least a profit of $5 per ton on making coke iron in Toronto. This includes the bonus from the Dominion Government of $2 per ton.

The Belmont Bessemer Ore Co. are reported to have about 50 men and some teams at work on the iron mine. They are sinking a shaft and also drifting, and are stripping the soil off the ore, having already exposed a large body. They say they will have the railway running into the mine in about a month, when they expect to put on a much larger force.

CANADIAN COMPANIES.

Rackarock Company (Limited) gives notice that application will be made under the Quebec Joint Stock Companies' Act for incorporation to manufacture explosives, chemicals, acids, fertilizers and materials for initial explosions, including fulminate caps, detonating caps, electric exploders, railway fog-signals safety-fuse and electric blasting machines, in the Province of Quebec. Head office, Sherbrooke. Capital stock, $35,000, in 350 shares of $100 each. The directors are Sylvester Wm. Jenckes, John Mardeau Jenckes and Frederick Arthur Halsey, manufacturers, all of the city of Sherbrooke.

The North American Chemical, Mining and Manufacturing Company has given notice of application for an order to change its corporate name to that of the Owen Sound Portland Cement Company. The change is desired on the ground that the company wish to obtain a name descriptive of their business, which principally consists in the manufacture and sale of Portland cement.

The Moncton Freestone Co.—Notice is given that application under the New Brunswick Joint Stock Companies Letters Patent Act will be made for Letters Patent for incorporation. The object for which incorporation is sought, is to purchase, own, sell, and deal in stone quarries and lands, to quarry, manufacture, purchase, sell and deal in stone for all purposes and such other things as are incident thereto. Head office, Moncton, Westmoreland Co., N.B. Capital, $10,000 in 100 shares of $100 each. The provisional directorate is made up as follows: Theophilus B. LeBlanc, contractor; Thomas Fitzsimmons, contractor; Robert A. Borden, barrister; Matthew Lodge, manufacturing agent; and Philip D. Bourque, quarryman; all of Moncton.

The Dominion Phosphate and Mining Co., (Ltd.)—The annual general meeting of the stockholders of the Dominion Phosphate Co., (Ltd.), was held at No. 103 St. Francois Xavier street, Montreal, on May 17th. No particulars of the business transacted have been received.

The National Oil Co., (Ltd.)—Messrs. Macbeth and Macpherson, solicitors for applicants, give notice that application under the Companies' Act will be made to incorporate the National Oil Co., (Ltd.) The objects for incorporation set forth are: The purchase of refineries, plant and machinery, the carrying on of the business of buying, leasing, letting and selling petroleum oil lands and other lands; buying, selling and producing oil and crude petroleum oil and other products thereof; sinking and putting down salt and oil wells, and otherwise developing salt and petroleum oil lands; working, leasing, buying, letting and selling oil refineries and salt works; manufacturing, buying and selling salt and petroleum oil and other products thereof; storing, tanking and warehousing refined and crude petroleum oil and other pro-

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Part R.—Chemical Contributions, by G. Christian Hoffmann. Price 25 cents.

Part S (a).—Mining and Mineral Statistics, 1888, by H. P. Brumell. Out of print.

Part S (b).—Mineral Statistics and Mines, 1889, by E. D. Ingall and H. P. Brumell. Price 25 cents.

Part T.—Annotated List of Minerals occurring in Canada, by G. Christian Hoffmann. Price 25 cents.

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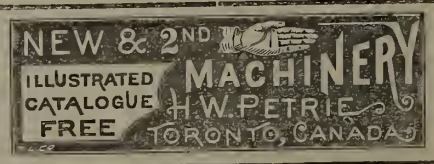
ducts thereof, and granting warehouse receipts for the same; constructing and operating pipe lines for the transportation of oil, and the doing of all such other things as are incidental or conducive to the attainment of the objects aforesaid throughout Canada. Head office, Petrolia. Capital stock, $150,000, in 1,500 shares of $100 each. The provisional directors are Messrs. John McDonald and James Fiddes, of Petrolia, and Charles Henry Schooley, of Toronto.

Gillies Bros. & Co., (Ltd.)—Messrs. Greig and Jamieson, Almonte, solicitors for applicants, give notice that application will be made under the Companies' Act, for incorporation, to acquire and take over as a going concern in all its branches, the business of lumbering and manufacturing of lumber now carried on by James Gillies, Wm. Gillies, John Gillies, under the name, style, and firm of Gillies Bros. One of the objects of incorporation is to carry on a general mining business, to buy and sell and otherwise deal in mines, mining lands and minerals; to prospect, explore for, quarry, develop, work, extract and mine throughout Canada, and for such purposes to construct, establish and operate works, wharves and warehouses, and acquire and own real estate for such purposes. Head office, Carleton Place, Lanark Co., Ont. Capital stock, $100,000 in 1,000 shares of $100 each. The provisional directors are: James Gillies, Wm. Gillies, David Gillies, John Stark Gillies, all of Carleton Place; John Gillies and John Albert Gillies of Braeside, Renfrew Co., all in Ontario.

Sudbury Customs Smelting Co.—The following letter has been issued by this company: "We regret that owing to the difficulty of securing sufficient stock outside this place at par, and the refusal of the government to assist by the appointment of an assayer and chemist for the company, the directors of the Customs Smelting company have decided not to ask for further subscriptions at present, and at the last meeting of the board unanimously passed the following resolution:

"Whereas the local government of Ontario, has not considered it advisable to grant the petition of the citizens of Sudbury, of the Toronto Board of Trade, and of the deputation of those interested in the mining industry of the Sudbury District, for the appointment of a government assayer and chemist for the Sudbury Customs Smelting Co., (Ltd.), this board does not consider it advisable to ask for any further subscriptions of the stock in the Sudbury Customs Smelting Co., (Ltd.), and that the amounts already subscribed by others than the provisional board be refunded, and the said subscribers be relieved from any further obligation."

General Mining Association.—Mr. J. D. Hill presided at the half yearly general meeting which took place last month at the offices in London, and in moving the adoption of the report and accounts said that he thought he might safely congratulate the shareholders upon the state of affairs—the more especially in view of the fact that it was proposed now to declare a dividend of 8s. per share, instead of 6s. per share, being an increase of something like 25 per cent. He could not say that this was anything very brilliant. Still, looking to the fact that there had not been that active demand for coal which might have been expected, and that this was an era of low prices, not only for coals but for almost every other article of commerce, he thought there was good ground for congratulation. He thought £4, at which their shares of £8 stood in the market, did not represent their actual value; for, taking the last ten years, they had paid on an average 7s. a share, which, with the shares at £4, worked out at 9 per cent. The report was duly agreed to, and a dividend of 8s. per share declared. The retiring director, Mr. W. S. Cunard, was re-elected, as was also Mr. W. B. L. Atkins, the auditor.



The Separation of Nickel From Iron.—Dr. A. Classen observes that if the acid solution is treated with sulphuretted hydrogen, and then the excess of sulphuretted hydrogen boiled off, the solution oxidized, and the iron precipitated with an excess of ammonia, the ferric hydrate precipitate so formed will contain weighable quantities of nickel. It is therefore to be redissolved in hydrochloric acid, neutralized with ammonia, ammonium carbonate added, and the iron precipitated as basic carbonate on boiling. This may be redissolved and reprecipitated if necesssary. When a precipitate has been obtained which consists of the oxides of nickel, cobalt and iron, these should be dried and reduced in a current of hydrogen. The weight of the metallic residue is then determined. It is then dissolved in nitric acid, neutralized almost completely with ammonia, amomnium carbonate is added, and the iron precipitated in the manner above described. The cobalt can be afterwards determined by precipitation with potassium nitrate. The weight of both nickel and cobalt having thus been ascertained, the difference between these and the joint weight of the three metals give the percentage of nickel. Both nickel and cobalt can also be separated from iron by precipitating them as oxalates; the double potassium iron oxalate is soluble.

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MINES OTHER THAN GOLD AND SILVER.

Licenses to s arch for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

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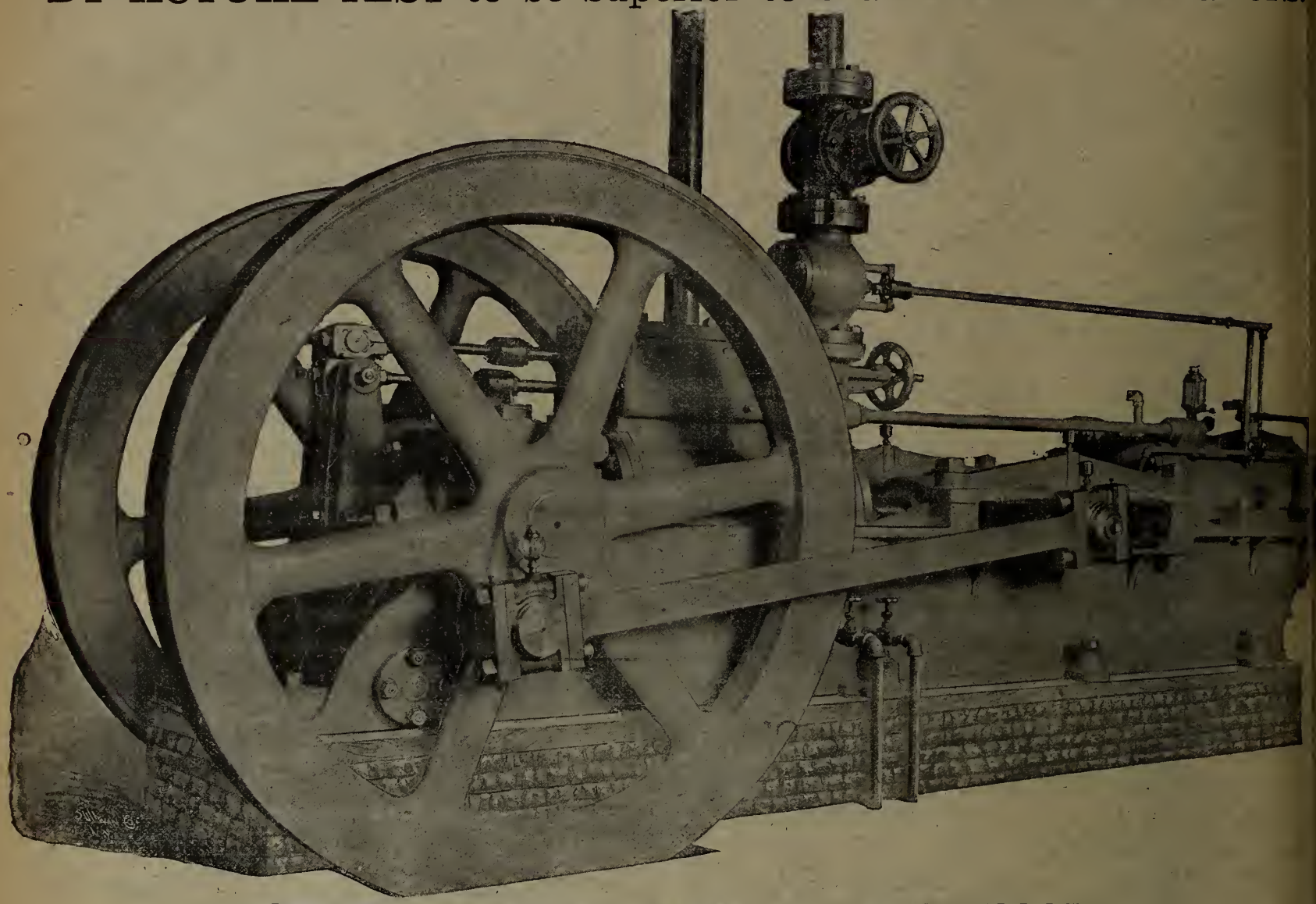

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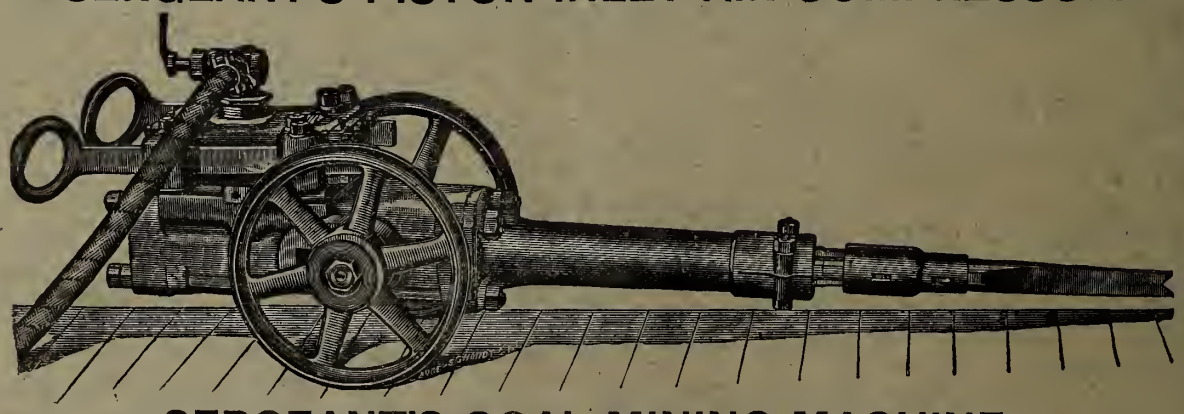

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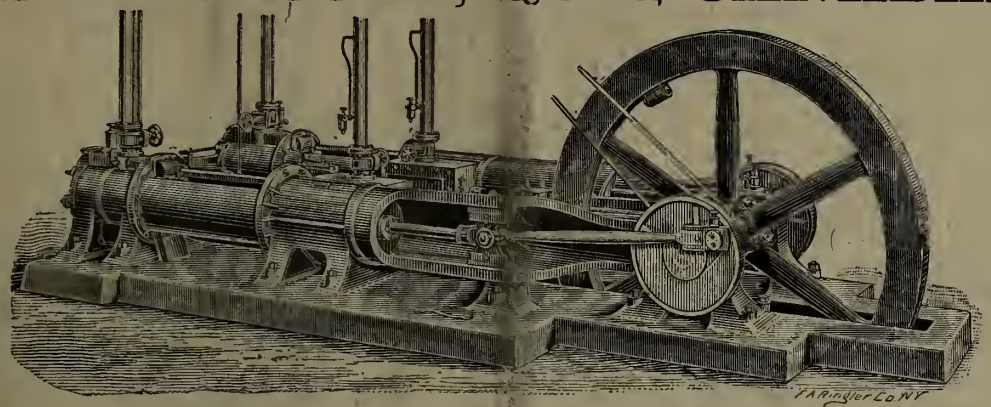

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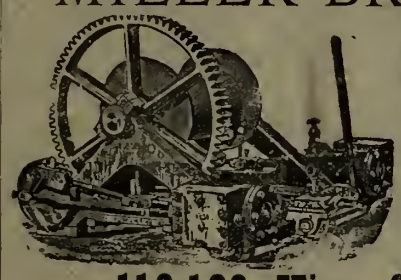

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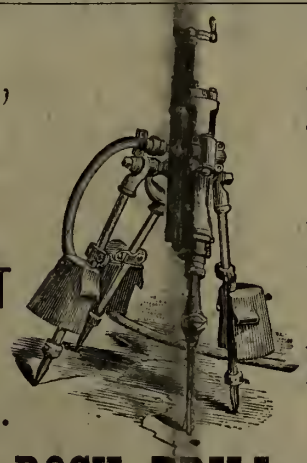

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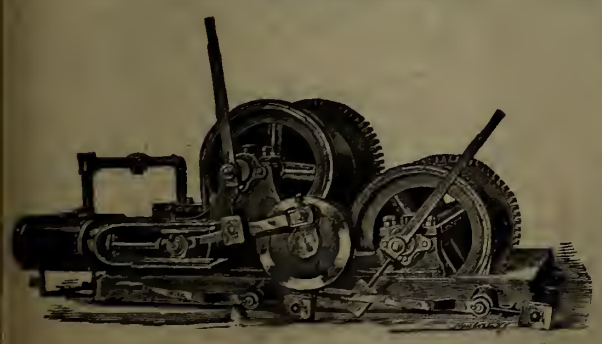

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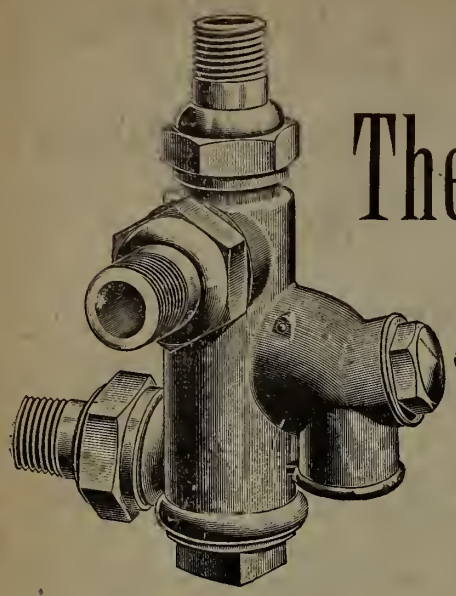

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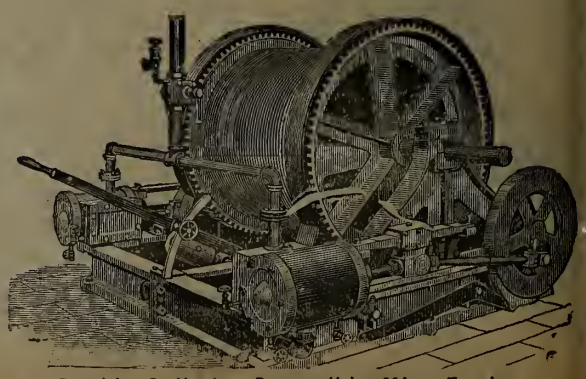

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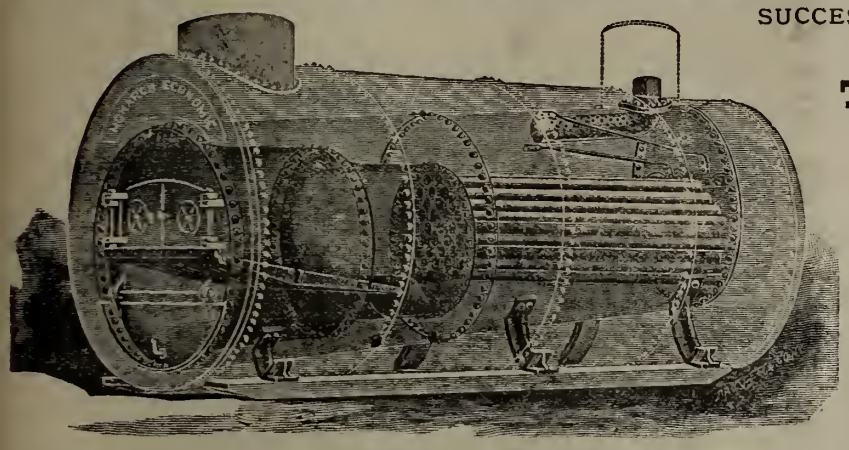

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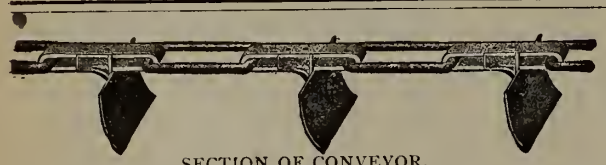

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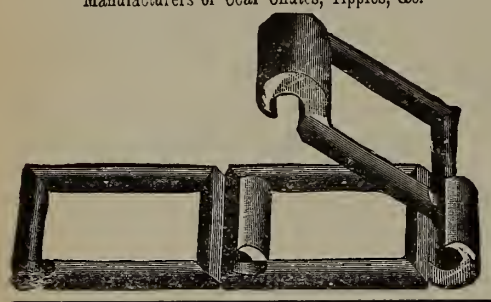

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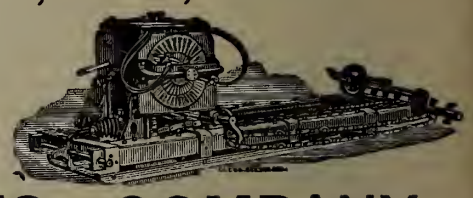

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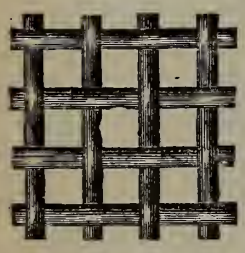

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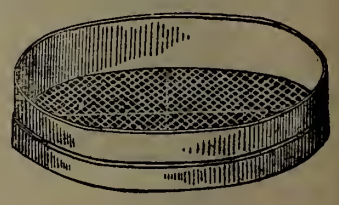

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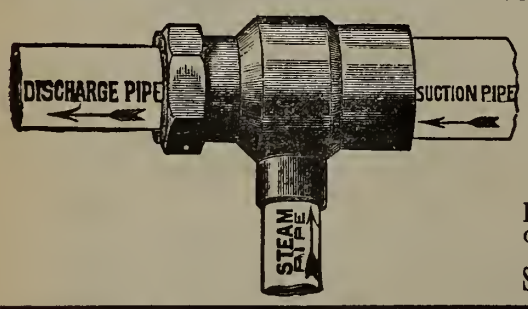

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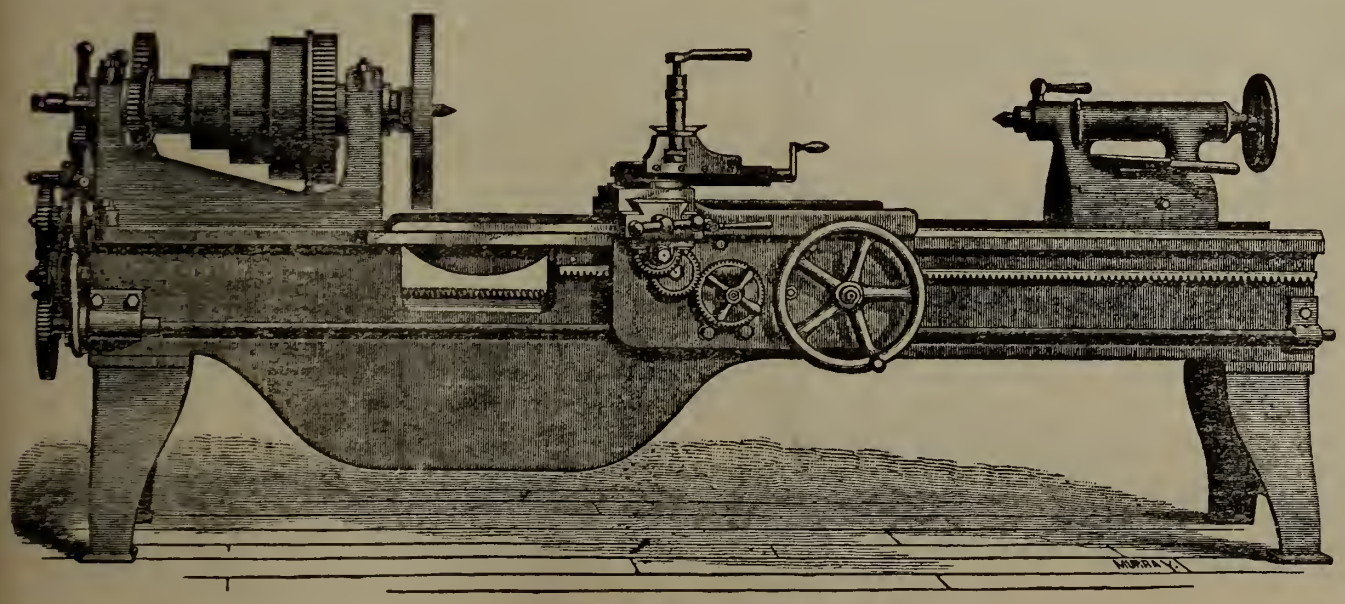

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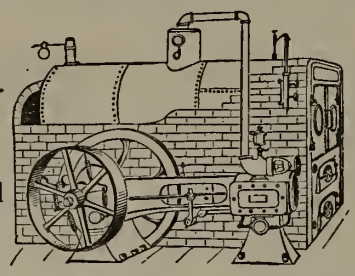

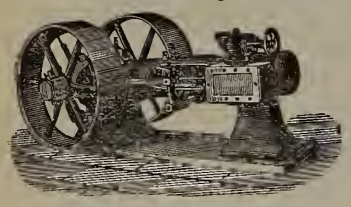

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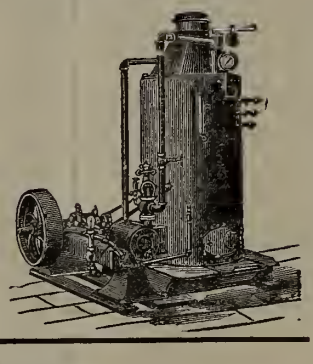

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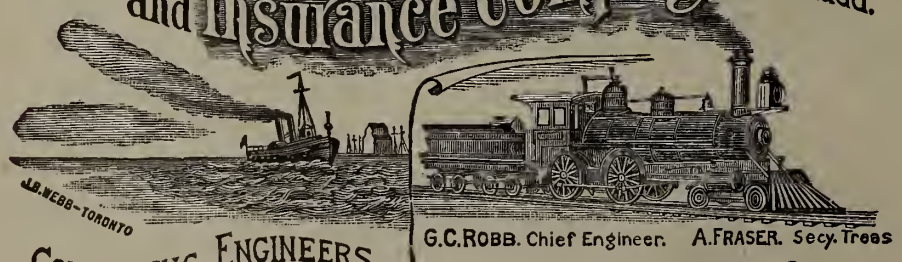

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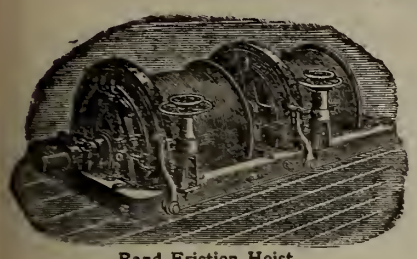

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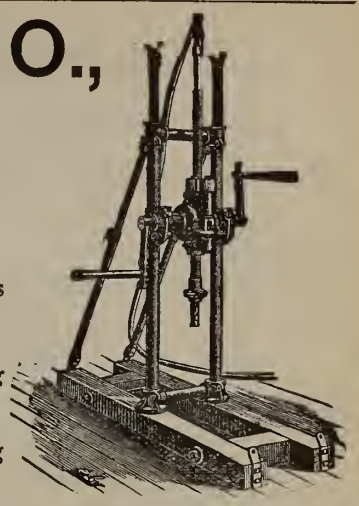

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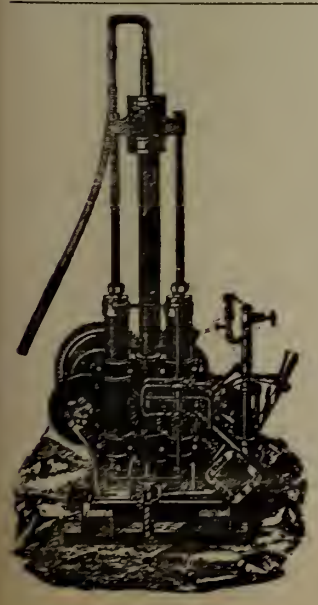

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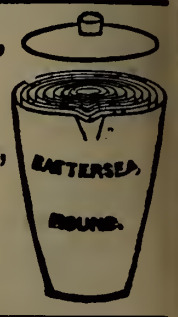

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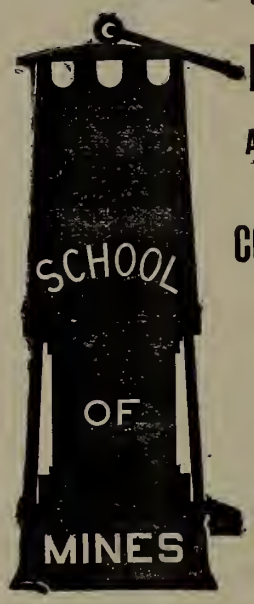

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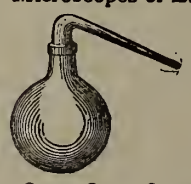

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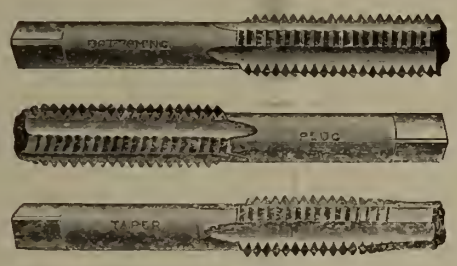

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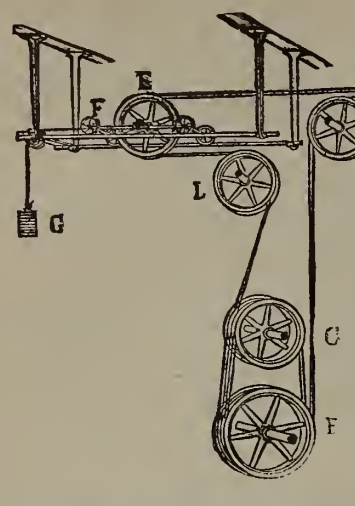

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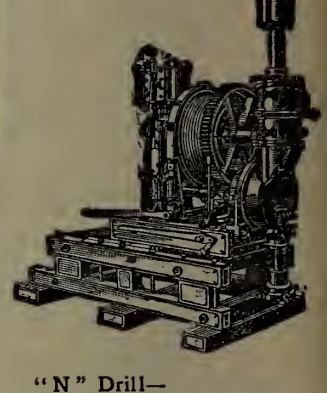

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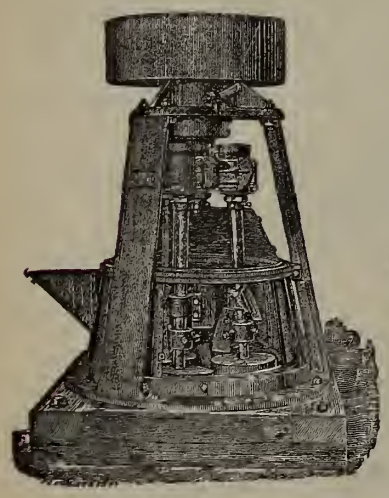

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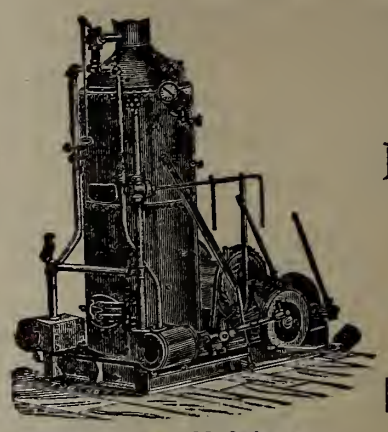

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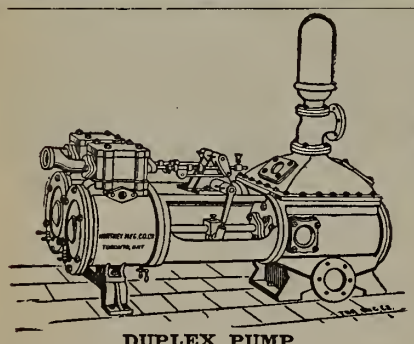

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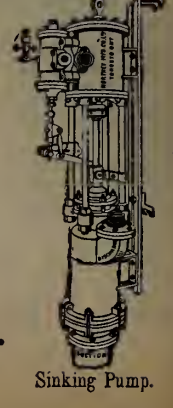

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THE GENERAL MINING ASSOCIATION OF QUEBEC.

THE following Resolutions of Council indicate beyond a peradventure the status of THE REVIEW as the exponent of the Canadian Mineral Industries:—

The Gold Miners' Association of Nova Scotia.

"At the annual meeting of the Gold Miners' Association of Nova Scotia, held at Halifax on 6th March, 1889, THE CANADIAN MINING REVIEW was adopted the official organ of this Association.

(Signed), B. C. WILSON, *President.*
G. J. PARTINGTON, *Secretary.*

The United Mining Society of Nova Scotia.

"Moved by Mr. R. G. Leckie, seconded by Mr. C. A. Dimock, That the thanks of the Society be tendered to Mr. B. T. A. Bell for his kind offer placing the columns of THE REVIEW at the disposal of the Society; and that THE CANADIAN MINING REVIEW is hereby appointed the official organ of the Society."

(Signed), H. S. POOLE, *President,*
H. M. WYLDE, *Secretary.*

The Asbestos Club, (Quebec.)

"Resolved: That THE CANADIAN MINING REVIEW is, by authority of the Members and Council, hereby appointed the official organ of the Asbestos Club."

(Signed), D. A. BROWN, *President.*
A. M. EVANS, *Secretary.*

The General Mining Association of the Province of Quebec.

At a meeting of Council held at Montreal on Friday, 6th May, 1891, it was moved by Captain Adams, seconded by Mr. R. T. Hopper, and resolved: That THE CANADIAN MINING REVIEW be the official organ of the Association.

(Signed), GEORGE IRVINE, *President.*
B. T. A. BELL, *Secretary.*"

OFFICES:
Victoria Chambers, 140 Wellington Street,
OTTAWA.

Vol. XI. JUNE, 1892. No. 6.

Mining Legislation in Nova Scotia.

Last year the Government amended the Mines Regulation Act in a very vigorous fashion, and have had the satisfaction of seeing the English Parliament since following its lead in several important changes in the English Act. During the present session of the Legislature the Mines Regulation Act was left untouched, and the Mines and Minerals Act was taken in hand. It was consolidated and amended in anticipation of the regular consolidation taking place in a year or two.

The amendments were principally for the purpose of making the Act clearer, or for facilitating the working of its provisions. The most important changes were as follows:—

Formerly the lines of gold leases and licenses were parallel to and at right angles to the general course of the strata. To prevent confusion in new ground these lines will run due north and south. Provision has also been made for adjusting disputes over surveyed lines.

Prospecting licenses were formerly for a period of six months and renewable for six months more; the cost of the first period being 50 cents, of the second 25 cents, per area. After much calculation it was considered that 50 cents an area for the twelve months was an equivalent for the old rate. The provisions of the Act relating to procedure in the Commissioner's Court, and to appeals from his decision, and the legal machinery generally was simplified.

In the case of minerals, other than of gold and silver, an important change has been made. Formerly a lease of one square mile was granted for mining any of the following minerals: coal, iron, copper, lead, tin ores, etc. At present the coal area or iron leases remain one square mile in extent. A lease for mining copper or lead cannot exceed one-half a square mile in extent; and one for tin or precious stones cannot exceed one-quarter of a square mile in extent. It may be mentioned here that the term of gold leases has been increased from twenty to forty years, so that the regularity of royalty and the duration of term in gold mining are well secured for a number of years to come.

The Act as amended had been in preparation for some time, and it is to be hoped that it will remain unchanged for a few years, especially as the coal and gold industries have endorsed it, excepting, of course in the matter of increased coal royalty.

EN PASSANT.

In view of the meetings of the General Mining Association of Quebec at Thetford and Black Lake on 14th, and the Mining Society of Nova Scotia at Halifax on 17th inst., the June number of the REVIEW has been issued somewhat earlier this month. Early in July we will publish verbatim reports of the proceedings at each of these meetings, in a double number.

From the sixteenth annual report of Inspectors of Explosives for Great Britain, we learn that during 1891 twelve varieties were added to the authorized list of explosives. Among the different explosives noticed in the report, two samples of gun-cotton may be mentioned. One had been in a river for sixteen years, the other underground for nearly twenty years. Neither had suffered in any way. During the year several new varieties of smokeless powder were introduced. The condition of all the samples examined (except one) was satisfactory. There was but one death caused from accident by fire or explosion in manufacture during the year, giving an average in ten years of seven. Altogether, in those processes alone to which the act applies—namely, manufacture, storage, and transport—there were sixty-two accidents, causing five deaths and injuring twenty-nine persons. These figures show a most satisfactory contrast with those given before the Act came into operation. In the use of explosives 105 accidents are reported, causing the death of thirty-nine persons, and injury to 101.

A subject of interest to Canadians was the discussion at a public meeting held in Dublin the other day to consider the development of the peat fuel resources of Ireland. It is estimated that there are 2,500,000 acres out of 20,000,000 acres under bog in that country. The peat in some districts was light and porous; this applies to the turf that lay near the surface. Where the turf was more than three or four feet deep it ultimately passed into a condition which nearly approached coal; the vegetable fibre was broken up and a highly carbonaceous and compact mass was the result. There was little difference between it and coal in specific gravity. Many years ago the town of Mullingar was lighted with gas made from peat. An experiment made with peat fuel in a locomotive on the Northern Counties Railway had shown that in strength it compared favorably with coal. Some authorities held that condensed peat made better gas than some kinds of coal, but it was thought that in this instance it could be used to better advantage when in conjunction with an inferior coal. The outcome of the meeting was a resolution: "That the utilization of the peat bogs of Ireland in all the various branches of industry they furnish is a subject well worthy of the attention of the capitalist, the land owner and the occuqier." Canada has an immense area of these same peat bogs, and it is interesting to note that an endeavor is now being made to manufacture the product into a compressed fuel suitable for steam and other purposes. It has been successfully utilized in Bremen, North Germany. There is no reason, judging by results obtained from recent experiments in Montreal and Toronto, why it should not be profitably turned to account in this country. The question of the utilization of the peat beds of Canada is one which has been receiving considerable attention of late, and several patents for its manufacture into fuel for steam purposes have been acquired by Montreal and Toronto people.

Meetings for June:—

GENERAL MINING ASSOCIATION OF QUEBEC, at Thetford and Black Lake, Que., Tuesday, June 14th.

THE MINING SOCIETY OF NOVA SCOTIA, at Halifax, on Friday, June 17th.

Members of these Associations will do well to be present and make a point of taking part in the proceedings.

The programme of the Thetford meeting embraces an interesting excursion to the asbestos mines. The papers to be read include: *The Labor Question in its Relation to Canadian Mining*, by J. Burley Smith, M.E., Glen Almond, Que.; *The Present Status of the Canadian Asbestos Industry*, by L. A. Klein, M.E., Black Lake, Que.; *Recent Practice in Economical Air-Compressors*, by F. A. Halsey, M.E., Sherbrooke, Que. A cold lunch will be served at Thetford mines at half-past twelve, noon. After the meeting, which takes place in the Asbestos Club House, Black Lake, members and their friends will be entertained to a dinner given in their honor by the local mine owners. Train leaves Sherbrooke Tuesday morning at eight o'clock.

The Mining Society of Nova Scotia will hold forenoon and afternoon sessions on Friday, 17th instant. Papers will be submitted by H. S.

Poole, John E. Hardman, J. Geo. Rutherford, J. S. McLennan, E. Gilpin, jr., and others. A programme of entertainment is being arranged for the evening.

According to the memorandum newly drawn up by British Trade Association, the production of coal is far from being so lucrative an occupation as some of the British miners appear to think. The latest available statistics (which might well be supplemented by others of a more recent date) show that during the ten years from 1877 the gross amount of mining profits in England and Wales assessed to income tax fell from £12,719,000 to £6,481,000, or rather more than half. Now, assuming the capital embarked in the coal trade at the latter date to be a hundred millions sterling, nearly as much more would be required to capitalize the other mining industries of the country, including ironstone, limestone, lead, copper, tin, etc. This would give us a total capital of some two hundred millions, upon which the six and a-half millions above mentioned would represent a profit of only 3 per cent. That this estimate is not too low is shown by various facts; among others, that in 1873 the evidence given by several witnesses before the Coal Committee went to show that the average profits of the coal trade over a period of years had not exceeded 2½ or 3 per cent.

The prolonged howl for an export duty on nickel and other minerals made by the *Canadian Manufacturer* is universally condemned by the mining interests of this country, and fully merits the following timely rebuke of the *Iron Trade Review*:—

> The capital of citizens of the United States has developed Canadian nickel and copper deposits, in large part built railroads which employed Canadian labor and required large outlays for materials. The mines have furnished employment to a large number of men; the transportation of their output has been of vast benefit to Canadian railroads. Yet in spite of the fact that her nickel industry has been initiated, developed and encouraged by capital from this side of the border, and the demand for the product created by the United States, with all the benefits to Canada that have flowed from this consummation—in the face of all these facts, there is a movement in Canada to put an export duty on nickel. Assuredly there is need for a wide publication in the land of the Canucks of an ancient fable about the fowl and the golden egg, with a moral about the people who didn't know prosperity when they saw it.

A French firm is experimenting with a new alloy for armour plates, projectiles, and guns, viz., a steel containing one per cent. of chromium, 2 per cent. of nickel, and not more than 0.4 per cent. of carbon. The steel is first melted in an open hearth, and in the ordinary way. When the silicon and manganese in the metal have attained their proper proportions, the nickel and chromium are added successively in the form of ferro-nickels and ferro-chromes, or in the shape of double ferro-chrome and nickel.

English papers record a notable instance of calm courage on the part of a miner named Sidlow when in the face of extreme danger. Sidlow and his companion were pit sinkers, and were engaged in blasting operations at a depth of 1,200 feet. Four charges were rammed, and a tape fuse, which would be long enough in burning to give them time to get away, was lighted. The men got into the hoppet and gave the signal, but to their dismay the bell was silent and the hoppet did not move. Sidlow instantly jumped out and tried to extinguish the smouldering fuze, but it had burnt too far into the hole for him to stop ignition. Sidlow did his utmost to reassure his companion, and both got into the hoppet again and crouched down. Immediately came the "shot," bringing down shattered fragments of stone and earth, which nearly buried the cage and enveloped the unfortunate miners in suffocating smoke. Poor Mullaney appears to have lost his senses from fear and excitement. He violently kicked his companion, and then lay still. He was dead! At length the hoppet began to ascend, and brave Sidlow, insensible, and almost suffocated, was taken to the surface. It was then found that the bell rope had accidentally broken, and the banksman was afraid to wind without the usual signal, fearing he might either injure the men or leave them behind. There seems no reason to doubt that the occurrence was purely accidental. Edward Sidlow owes his life to his own calm courage, and is entitled to great praise for the efforts he made, unhappily without success, to impart courage to his companion.

Apropos of Dobson, a Toronto gentleman well versed in his career in that city, sends us the following: "Mr. James Hedley, editor of *The Monetary Times*, Toronto, has just returned from Chicago, where he tells me he met a much aggrieved individual named C. M. Dobson, who was complaining bitterly of the way he had been treated by the REVIEW, threatening libel suits and blustering considerably. Hedley knew nothing of Dobson's antecedents or his career when here, and he asked if I could tell him anything about him. Hedley says that Dobson admitted having used the A.R.S.M. when he had no right to, but pleads that he did so when young and foolish. Col. ——— says, however, that he is using these letters yet. You will notice that in his letter to the Ottawa *Free Press* Dobson does not say that he was or is an Associate, but merely that he attended the Royal School of Mines, Jermyn Street, London, for three years. I suppose that Mr. T—— told you about the fraudulent affidavit regarding a certain lot in Ontario in which Dobson swears he visited it on a certain day, when, as a matter of fact, he had never left Toronto. His affidavit is filed in the Crown Lands Office here and can be seen any time. I think you ought to get all particulars and publish the facts." With all due deference to the suggestion of our esteemed correspondent we must, for reasons already stated, decline to give any details of Dobson's career. Our object in warning our readers against a first-class fraud has been accomplished.

The Krupp works at Essen keep no less than 20,000 men constantly employed, burn daily 1,700 tons of coal and coke, and consume 26,000 cubic metres (918.231 cubic feet) of gas. The various departments and shops are connected by 44 kilometres (27 miles) of normal way, served by 14 locomotives and 542 waggons, besides 29 kilometres (18 miles) of small-gauge way, with 14 locomotives and 450 waggons. There are 140 telephone lines, and 80 kilometres (50 miles) of telegraph lines. The works also contain 2,542 furnaces of all kinds, 21 roll trains, 82 steam hammers, 450 steam engines of 2 to 1,000 horse-power, 439 boilers, and 1,622 machine tools and other mechanical appliances.

Among the applications of electricity to machinery that of its union with travelling cranes is of no mean importance. Instead of having a certain predetermined speed of travel and hoist, that cannot be departed from, the electric crane possesses the advantage of being under perfect control of the operator, can be gradually accelerated or retarded, smoothly and noiselessly, or may be kept at the same speed indefinitely. Three 15 ton cranes are in operation in a Milwaukee shop, having a hoisting speed of 25 feet per minute, a longitudinal traverse speed of 350 feet and a transverse traverse speed of 125 per minute.

An improved coal-mining machine has been patented by Mr. J. Taylor, Illinois, U. S. A., which is designed to be operated by an electric motor placed on the machine. The machine is advanced by hand or by any available power as the cutting proceeds until the body of coal to be detached is undermined. A stationary frame is secured to fixed support, and two arms extending forward are pivotted to the frame, the cutting wheel being journalled between the ends of the arms. The cutters in the rim of the wheel are removable, their shanks extending through the rim and receiving nuts. There is a toothed rim on the upper face of the cutting wheel, engaged by a bevelled pinion on a shaft journalled in bearings on the upper pivotted arm, this shaft also having a spur wheel for receiving power from an electric motor. Owing to the construction of the arms carrying the cutting wheel, the wheel is adapted to cut a grove in the body of the coal equal in depth to nearly its own diameter.

One of the 4in. nickel steel armour plates for the cruiser *New York* was tested the other day. Three shots were fired from 4in. guns, with an initial velocity of 1,420 feet per second. Carpenter projectiles were used, and all rebounded without piercing the plates.

The *Electrical Review* notices a method of examining the atmosphere in mines which is now being used at Kolcheid, near Aachen. Briefly, it is as follows:—A gasometer is placed in the chief ventilating shaft and is so arranged that it becomes filled in twelve hours; in this way it is possible to obtain a fair average sample of the mine air. The air thus collected is now examined by means of a Coquillon's "grisometer." Any free carbonic acid gas that may be present is absorbed by caustic soda, and its percentage estimated by noting the diminution in bulk. The marsh gas is now decomposed by a platinum wire heated to incandescence by means of an electric current. A furthur diminution in bulk takes place, and this being observed, the percentage of marsh gas present in the pit air can be calculated.

Our Portrait Gallery.

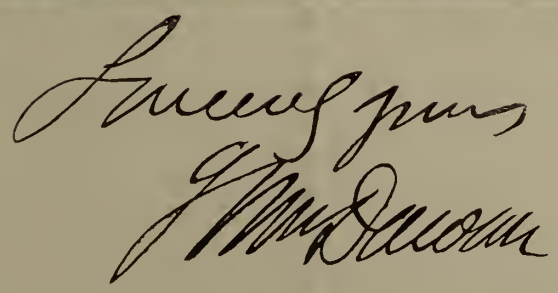
[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. 17.

Sir John William Dawson, C.M.G., LL.D., F.R.S., F.G.S., etc., etc., Principal of McGill University, Montreal.

Amongst the foremost scientific men of this age, not only in America, but also in Europe, we find the subject of this sketch.

But few men have lived to enjoy so fully the results of a life full of activity and unceasing devotion to the advancement, progress and research in almost every department of life. To-day, Sir William is as actively engaged in matters scientific, educational, and religious, as he was in the prime of his manhood, and time seems not to have made even the slightest impression upon his zeal or earnestness, upon his love for work. Endowed with a splendid physique and a superabundance of intellectual power, Sir William Dawson strives in the world to-day, and is known, beloved, and respected by millions on both sides of the Atlantic.



Born in the town of Pictou, Nova Scotia, in 1820, young Dawson received his early training and education there. One of his favourite hobbies was the collecting of natural history specimens peculiar to his province. At the age of twenty he went to the Edinburgh University, Scotland, to make more extended studies. In 1842 we find him assisting Sir Charles Lyell, then one of the ablest of living geologists, in his examination of the geological resources of Nova Scotia. Subsequent to this, the subject of this notice returned to Edinburgh and made further studies, especially in the science of chemistry, and kindred branches. His first paper on "Field Mice" was read before the "Wernerian Society" of Edinburgh, in 1841. Then followed several papers on various branches of science, but he was soon back to his birth place, where he was appointed by Sir Edmund Head a commissioner to regulate the affairs of King's College. Educational matters now occupied most of his time. But his favourite study, geology, soon made its way out, and he lost no opportunity of carrying on investigations into the coal, iron and gypsum deposits of Nova Scotia. Fossil plants attracted his attention from earliest times, and now he is foremost as a palæobotanist, in which subject Sir William decidedly excels. The *Edinburgh Philosophical Journal*, the *Royal Society* publications, and the other leading magazines and periodicals were now open for articles from his facile pen. Papers bearing upon the economic resources of Nova Scotia show the interest and active part which he took in the development of natural resources in those early days. With never-flagging zeal he pursued his geological studies, which led to important discoveries.

He was then called upon to deliver lectures on geology and natural history in Pictou Academy, Dalhousie College, and was entrusted with a "Report on the Coal Fields of Southern Cape Breton" for the Nova Scotia Government.

In 1854 he was elected Fellow of the Geological Society of London, to whose quarterly journals he has ever since contributed numerous useful and interesting papers. He discovered and described the oldest known reptiles at the time, and the remains of the earliest land snails known. In 1855 Mr. Dawson published his well-known work, "Acadian Geology," on the geological structure, organic remains, and mineral resources of Nova Scotia, New Brunswick, and Prince Edward Island. This admirable and indispensable work to the student of geology has since gone through several editions, and is now more than double its original size. In his researches on the vegetation of the Devonian period, prior to the Carboniferous, or Coal measures, Dawson's name stands foremost. It was to his friend and colleague, Sir Charles Lyell, that his "Acadian Geology" was dedicated.

In the same year (1855) Mr. Dawson was called upon by the authorities of McGill College to take the principalship of that institution. A comparison of the condition of the college in 1855 with what it is now is sufficient warrant to any one of the long-sightedness and wise policy of the Board of Governors, as well as a distinct mark and standing monument to his industry, zeal, and practical ideas on educational matters. Besides his more scientific works on geology, and hundreds of papers on divers facts and observations, Dr. Dawson (as he has been wont to be called for many a year) published a number of popular works, amongst which we may mention the following: "The Origin of the World," "The Story of the Earth and Man," "The Dawn of Life," "Fossil Men and their Modern Representatives," "The Chain of Life in Geological Time," etc., etc.

In his researches on *Eozoon Canadense*, conjointly with Sir William Logan, Dr. W. B. Carpenter, Dr. T. Sterry Hunt, and many others, Dr. Dawson has created for himself a reputation and a name which stands high. Amongst the text books which he wrote we find his "Acadian Geology," "Manual of Zoology," especially adapted to Canadian students; "Lecture Notes on Geology," a most useful and comprehensive digest or *resume* of geology. We have, besides, numerous other works, amongst which are his Reports on the Devonian and Carboniferous Plants of Canada, prepared and published by the Geological Survey of Canada, by Act of Parliament.

In 1862 Dr. Dawson was elected Fellow of the Royal Society of England, the highest honour which a British scientist can obtain from his *confreres* and admirers. In 1882 he was elected as President to the Royal Society of Canada, founded by the Marquis of Lorne. He has been President of both the American and British Associations for the Advancement of Science more than once. He is a Master of Arts of Edinburgh University, an LL.D. of McGill, whilst in 1884 Her Majesty the Queen was pleased to bestow upon him the Order of Knight Bachelor, in recognition of his valuable services to science, and his Alma Mater in the same year created him an LL.D. of that University.

As a geologist, and an educationalist, Sir William Dawson to-day stands high. His flowing words and store of knowledge make him interesting and attractive at all times. In the domain of archæology and archæological remains, Sir William has made extensive researches here in Canada, described many of the implements and remains of the earliest dwellers on this continent, connecting therewith almost invariably the related topic so brimful of interest as to the "Antiquity of Man."

Like MM. deQuatrefages and E. deLaveleye, just recently deceased, and Dr. Dana, Sir William Dawson is not only hard-working and painstaking in his researches in science, but also a Christian in the highest practical sense of that term.

Throughout the whole length of his life one can see the continuous thread of an existence which has a higher motive power at its back. In the world of higher Biblical criticism, of reconciling "Science and Religion," Sir William Dawson has done much to clear up numerous and important, as well as intricate questions, which required careful comparisons and accurate observations. "Facts and Fancies of Modern Science," "Modern Ideas of Evolution," and similar works of captivating interest and philosophic turn of mind are amongst his best known works, whilst his works and papers on Egypt

and Syria are not less profitable. It shows us clearly, then, that the sphere of scientific research is by no means incompatible with that of higher culture and Christian ethics.

The Director of the U. S. Mint has estimated the total output of silver throughout the world in 1891 as 140,865,000 ounces, showing an increase of 8,032,000 ounces compared with 1890, or an increase of about 5½ per cent. The value of the output last year, however, is returned as 300-000 dollars less than in 1890, owing to the fall in price. The price averages for the last three years were as follows;—1889, 93·5 cents; 1890 (the year in which the Silver Act was passed), 1·05 dollars; 1891, 98·8 cents, It is predicted that the output will fall off considerably this year. As regards the increased output of last year, it must be pointed out that it was considerably more than covered by the increased purchases on account of the Treasury to the extent of about 14,-000,000 ounces, as against 1890, that is, deducting from the total Treasury purchases of last year the similar purchases under the Silver Act and its predecessor, the Bland Act, in 1890.

From returns furnished by our New York correspondent, the shipments of Florida phosphates, 75/80%, from 1st January, 1892, to 21st May, have been as follows:—

To Barbadoes	782	tons.
" Liverpool	3,442	"
" London	7,520	"
" Hamburg	6,200	"
" Stettin	8,004	"
" Rotterdam	2,486	"
" Copenhagen	1,900	"
" Denzig	1,540	"
" Genoa	2,338	"
" Munich	1,875	"
" Ipswich	1,475	"
" Baltimore (U.S.)	812	"
" Valencia	505	"
" Wilmington (U.S.)	840	"
" Kastrup	1,645	"
" Boness	3,250	"
Total	44,614	"

A correspondent informs the *Engineering News* of a remarkable accident that occurred recently to what is probably the longest single span cable-way in the world, being that at the Deer Park group of mines, near Descanso, California, used for conveying ore from the mines high up a mountain side to the mills below. It has a single span of 4,450 ft. and has a tension of about 20 tons. The loads were 120 lb. sacks of ore. It was a working success for two days. It parted just after an extra hard "shake" in the series of earthquakes to which that part of California has been subjected. It is supposed that the vibrations coming from the end of the line and meeting in the middle were the cause of the break. It will be replaced by a heavier one.

Big Gas Meters.—The meter department of the Pittsburgh Supply Company is making two of the largest meters ever made. They are for use on natural gas lines, where the pressure runs up to 60 pounds to the square inch. When worked at ordinary mill pressures of from 5 to 6 ounces they have a capacity of 100,000 cubic feet per hour, but can be worked up to 120,000, and when working at 60 pounds pressure they register from 500,000 to 600,000 feet per hour, or from 12,000,000 to 15,000,-000 cubic feet per day, more than a great many wells can furnish. These meters will be used on lines at Buffalo, N.Y. In addition to the above the company is working on orders for eight meters with a capacity of 10,000 feet per hour, and two with a capacity of 50,000. This company carries a large stock of meters on hand, with capacities ranging from 10,000 to 100,000 feet per hour. It is at present designing a new meter, which will be put on the market in the near future, and is intended for fuel gas for house purposes and illuminating gas for general purposes.

Explosions in Coal Mines.*

By J. B. Atkinson.

No industry has been subject to disasters involving so large a loss of life as coal mining, and these disasters have been principally due to explosions.

The magnitude of colliery explosions has strongly directed public attention to the dangers of mining, and has led to the passing of Mines' Regulation Acts, each more stringent in its provisions than its predecessor. It is now held by many persons that the extension of nearly all the larger explosions has been caused by coal dust, and even that some explosions have been wholly due to the combustion of that agent.

The words "coal dust" do not occur in any Mines' Regulation Act except that of 1887. It is evident, therefore, that an important factor in colliery explosions has been overlooked, and it is probable that many explosions have occurred simply from a want of knowledge in which all connected with mining have shared.

The influence of fire-damp in explosions has been two-fold, it is itself the cause of explosions, and it has diverted attention from another factor—coal dust.

We may even go further, and say that one of the precautions, large currents of air, adopted to lessen the danger of fire-damp, has directly assisted in increasing the danger of coal dust by rendering the mines dryer, and promoting the formation of the most dangerous class of dust deposits, those due to the fine upper or wind-borne dust and common on many main intake and haulage roads.

If these considerations be true it is clear that our knowledge of the causes of colliery explosions, and of means for their prevention, will require to be recast, and in this paper attention will be especially directed to coal dust as the cause of explosions that is least understood. Explosion may be defined as the sudden large increase in volume of matter.

In practice accidental explosions are of the following kinds:—

(*a*) The expansion of gunpowder and allied explosives on combustion.
(*b*) ,, ,, dynamite and allied explosives on disassociation.
(*c*) ,, ,, mixtures of inflammable gases or vapours with air on combustion.
(*d*) ,, ,, mixtures of inflammable dust with air on combustion.
(*e*) ,, ,, gases or vapours under pressure on the rupture of retaining walls.

a, *b*, *c*, and *d* may be called chemical explosions, and are accompanied by flame; *e* may be called a mechanical explosion, and is not accompanied by flame.

Explosions under the above heads occur in mines. This paper will, however, be confined to the consideration of the explosion of mixtures of fire-damp and air, and of mixtures of coal dust and air, and also of gunpowder and other explosives, so far as they initiate the two former classes of explosions.

A true explosive is a body containing within itself the power of explosion. Thus gunpowder on the application of heat, or nitro-glycerine compounds on detonation or shock, explode without the assistance of any other body. These are true explosives. Fire-damp and coal dust are not explosives. Mixtures of fire-damp and air or of coal dust and air are explosive, but the oxygen of the air is as essential to the explosion as the fire-damp or coal dust. It is scientifically incorrect to speak of the explosion of fire-damp or coal dust. Gunpowder is an example of a solid explosive, nitro-glycerine of a liquid explosive, and there are explosive gases, but they are never met with out of the laboratory. Thus one of the oxides of chlorine (hypochlorous acid) is an explosive gas. When slightly heated it decomposes with explosion.

Fire-damp is usually a mixture of marsh gas, with nitrogen, oxygen, and carbonic acid gases. The marsh gas or light carburetted hydrogen is the combustible constituent. Fire-damp is pent up in the strata at high pressures, and issues into the workings of a mine, usually as a steady flow, but sometimes as a sudden outburst In elevated unventilated parts of mines it collects, and often issues from such places in large volume on a fall of the barometer.

When flame is applied to fire-damp issuing as a jet into the atmosphere, it burns at the point of issue like ordinary lighting gas. There is combustion but no explosion. If mixed with air in certain proportion, flame passes rapidly through the mixture, and explosion results, the explosion being wholly due to the expansion of the resultant gases, caused by the heat of combustion. There is no absolute increase in volume of the mass, such as takes place when gunpowder is fired, when the resultant products, apart from the expansion due to the heat of combustion, occupy many times the volume of the original gunpowder.

The temperature of ignition of an inflammable mixture of fire-damp and air, the speed of the passage of flame, the temperature of combustion, the increase in volume of the resultant gases if free to expand, the increase of pressure if confined, and the composition of the resultant gases, are all points for consideration to which it is not proposed to direct attention. Recent researches, however, have shown that, as regards the speed of flame, the pressure developed, and the composition of the resultant gases of an explosion of fire-damp and air, the older text books are not altogether correct.

Coal dust is more or less prevalent in all dry coal mines. When the heat of a mine raises the temperature of the air entering the mine its capacity for absorbing moisture, or its drying power, is increased; and if the quantity of moisture in the strata mined, and that due to the respiration of men and horses, and to the combustion of lights, is not sufficient to saturate the air, the mine becomes dry. The temperature of the strata increases with the depth, while the quantity of moisture usually decreases. Deep mines are, therefore, dryer than shallow mines.

Some coal seams produce more dust than others—the more friable the coal the more dust. Coal seams are traversed by joints or cleavage planes running at right angles to the plane of stratification, and by partings parallel to the stratification. The latter planes of division are very generally coated with a dull, black, friable substance, known as mother of coal, dant, or mineral charcoal, which probably is largely present in fine coal dust.

The hewing, filling, and leading of the coal are the principal causes of coal dust deposits in mines. Two other causes are (1) the falling of coal from the sides of the passages, and its subsequent tituration by the feet of men and horses, and (2) the carrying down of coal dust from the screens on the surface by the air current descending the downcast shaft.

If a pound of ordinary coal is placed upon a fire it burns and is eventually consumed; first the combustible gases that are driven off combine with the oxygen of the air, producing flame and heat; next the solid carbon is consumed until nothing but ash remains. It can be shown by calculation that if the combustion of the pound of coal took place suddenly the heat given off would so expand the resultant gases that explosion would result, exactly as in the case of the combustion of fire-damp. If the pound of coal was in the form of fine dust and suspended in air, under some conditions such rapid combustion will take place, and this is a coal-dust explosion.

The explosions of fire-damp and air and of coal dust and air are therefore in some respects similar phenomena; in each case the explosion depends on the heat of combustion expanding the resultant gases, and each explosion is accompanied by flame and a vitiation of the atmosphere. A mixture of fire-damp and air readily takes place—the motion of the air in a mine, the mobility of the fire-damp, and the property of diffusion which gases possess, even when stationary, all favour the mixture. The fire-damp is readily ignited, and does not require to be broken up before combustion takes place.

With coal dust and air the conditions are different, and opposed both to the ready formation of an explosive mixture and its subsequent ignition.

Coal dust is a solid body; it is not present in the air of a mine under ordinary conditions in any considerable quantity, but requires to be raised from the floor or dislodged from the sides and roof before a cloud is formed; it requires to be broken up, or the gases it contains driven off, before combustion takes place. The combined effect of these conditions makes it difficult to initiate an explosion of coal dust and air. The fact that it requires special conditions to obtain an inflammation of a cloud of coal dust in an air free from fire-damp does not, however, prove that the extention of an explosion in such a mixture is equally difficult to obtain, because the conditions are then different. After an explosion is started in a mine the coal dust is no longer quiescent, but is blown into the air by the explosion, and forms a dense cloud; behind this cloud is heat, flame, and pressure. The behaviour of coal on an ordinary fire resembles somewhat that of coal dust in an explosion. The first step to start a coal fire is to ignite paper. The paper ignites wood, which in turn ignites the coal; once a coal fire is throughly kindled it is self supporting, but the coal cannot in the first instance be readily ignited without the assistance of heat from other material.

The heat and consequent force developed hy the inflammation of a mixture of fire-damp and air in such proportion as to secure complete combustion is greater then the heat and force developed by a similar mixture of coal dust and air.

Mixtures of fire-damp and air are, however, only capable of transmitting flame within certain limits. There must he from 5 to 20% by volume of fire-damp in the mixture. The case, with respect to coal dust and air, does not appear to be parallel. One pound of coal dust and 160 cubic feet of air are required for complete combustion. Assuming an air-way to be 8ft. by 5ft. sectional area, and taking coal dust to weigh 26 lbs. per cubic foot, then for each 160 cubic feet of air in such a road to be supplied with 1lb. of coal dust, the surfaces of the road would require to be coated with a film of dust $\frac{1}{232}$ inch thick. Such a quantity is far below what in practice is present on ordinary dusty roads, along many of which it has been observed that an explosion has passed with great force. These roads would, at the time of the explosion, have suspended in the air a quantity of dust in excess of 1lb. to 160 cubic feet of air, and in no case where the dust was pure has the writer seen any evidence that the passage of an explosion has been checked by an excess of dust. It seems that in a coal dust explosion a minimum quantity of dust must be present, which is probably much greater than the quantity named as being required for perfect combustion, but practically no maximum. If this be true, it has an important bearing on the question. The minimum quantity of coal dust occurs constantly over long lengths of roads in mines, and consequently the conditions are present for the propagation of a coal dust explosion. That is to say, many roads in mines, in their normal condition, contain the necessary agents for an explosion of coal dust and air; while a similar state of

*Transactions Mining Institute of Scotland.

things, due to the presence of fire-damp and air, is an abnormal condition.

With regard to the force developed by an explosion of coal dust and air, as compared with the force developed by the explosion of fire damp and air, the following is worth consideration :—

In an explosion confined to coal dust and air, traversing a road in a mine containing a large excess of fine coal dust, there will probably be only coal gas distilled from the dust consumed ; the combustion of coal gas results in more heat than the combustion of an equal volume of fire-damp, the coal gas containing free hydrogen ; if this excess of heat is equal to the heat absorbed in distilling the coal gas from the dust, then the heat available to expand the resultant gases will be as great in the one case as in the other. Experience in actual explosions shows that, where there is a large excess of fine coal dust, the force developed is greatest.

In an explosion of either fire-damp and air or coal dust and air, a limiting factor is the quantity of air the road contains ; fire-damp, if present in volume so as to form the most explosive mixture, occupies one-tenth of the air space ; coal dust may be present in excess, and yet practically leave the road full of air.

Sir F. A. Abel, when experimenting on coal dusts, observed that one of the samples of dust, consisting largely of stone dust, had the property of determining the ignition of a mixture of fire-damp and air not inflammable *per se*. This led him to experiment under similar conditions with non-inflammable dust, such as calcined magnesia, and he obtained similar results—that is to say, a mixture of fire-damp and air not inflammable *per se*, became so on the addition of a non-inflammable dust. This shows that coal dust may act in two ways in explosions :—1st, it may supply combustible matter ; and 2nd, it may cause mixtures of fire-damp and air not inflammable *per se*, to become capable of transmitting flame.

Having satisfied ourselves that fire-damp and coal dust are the only bodies that, in conjunction with air, cause explosions in mines, we can investigate the subject (1) by the study of actual explosions, and (2) by experiment.

Explosions may be studied by observation made in the mine after their occurrence, or by the perusal of published accounts.

The writer has visited the scene of a large number of explosions in mines, most of which were caused by the ignition of small quantities of fire-damp, and were not generally followed by any death, or caused much damage to the mine. Some of these ignitions resulted in one or two deaths—the persons injured usually living for a few days after the accident. In a few cases of undoubted fire-damp explosions, lives were lost in the mine, but this was exceptional.

The most considerable explosion of fire-damp which the writer has personally investigated occurred at Whitehaven Colliery on the 25th April, 1885.*

In a few cases of minor explosions, investigated by the writer, coal dust had some influence, more as extending the flame of a gunpowder shot.

The writer has had opportunity of becoming acquainted with the circumstances attending the large explosions described in Table I., soon after their occurrence, and he at the same time made more or less complete examinations of the mines ; he believes that in these explosions coal dust played a leading part.

The explosions in the table are, it must be noted, not selected, but comprise all the large explosions the writer has personally investigated.

TABLE 1.

No.	Colliery.	Date.	Lives lost.	Flame causing explosion.	Agent first inflamed.	Agent causing extension of explosion.	Point of origin of explosion.
1	Seaham.....	25th October, 1871..	26	Gunpowder shot	Coal dust....	Coal dust.....	Intake air way
2	do	8th September, 1880	164	do	do	do	do
3	Trimdon Grange..	16th February, 1882	74	Open light.....	Fire-damp...	do	Engine landing next drowned workings
4	Tudhoe.....	18th April, 1882....	37	Gunpowder shot	Coal dust....	do	Intake air way
5	West Stanley ...	19th April, 1882....	13	do	Coal dust & % of fire-damp	do	Working face
6	Usworth.....	2nd March, 1885...	42	do	Coal dust....	do	Intake air way
7	Altofts.....	2nd October, 1886..	22	do	do	do	do
8	Ellemore.....	2nd December, 1886	28	do	do	do	do
9	Walker.....	24th October, 1887..	8	do	Coal dust & % of fire-damp	do	Working face
10	St. Helens.....	19th April, 1888....	30	Fire in the mine	Fire-damp...	Fire-damp, coal gas & coal dust.	do

The reasons that lead to the conclusion that coal dust was the principal factor in these explosions will be stated shortly.

First, there are reasons of a negative character depending on the apparent impossibility of ascribing the explosions to the combustion of fire-damp, the only body other than coal dust likely to cause them.

In Nos. 1, 2, 4 and 7, the explosions were entirely confined to the intake air ways ; in Nos. 3, 6 and 8, the principal effects of the explosions were observed on the intake air ways, although some of the working faces were traversed, and the return air ways were affected to a very limited extent. In No. 5 the intake air ways, the working faces, and the return air ways were all traversed. In No. 9, a small explosion, the working face and return air way of one district were affected. In No. 10 the working face of one district and intake air way were traversed, but owing to operations that were being carried out to isolate a fire at the working face, the direction of the air current had been changed shortly before the explosion, and a part of the intake air way was return air way at the time.

On the whole, the explosions had traversed longer distances of intake air ways than other parts of the mines, in some cases being entirely confined to such roads. That is to say the roads least likely to contain fire-damp were most affected.

Experience in mines would justify the expectation that an immensely greater proportion of explosions of fire damp would extend along the return air ways than along the intake air ways, whereas the reverse was the case in these explosions.

In the North of England, where this feature had long ago been observed, it has been customary to say with what has been termed "the unlearned wisdom of experience" that explosions of fire-damp always faced the fresh air, or that the gas sought the purest air.

In some of these explosions it was observed that the blast on arriving at points on the intake air ways where the air current split, had afterwards traversed one of the splits only. If the air current, before dividing, and in one of the splits, was in an explosive condition through the presence of fire damp, how did the other split escape being in a similar state? In one case it was observed that the split which escaped was a continuation of the straight line which was the course of the explosion up to that point, the split traversed by the explosion deflecting to one side.

In Nos. 1, 2, 3, 4, 5, 6, 7, 8, and 9, so far as a judgment could be formed, no person in the mine was in a state of alarm at the moment of the explosion.

In No. 10 the mine was on fire, and all the ordinary workmen had left the pit. The persons who were in the mine at the time of the explosion, engaged in isolating the fire, were, however, under no apprehension of a large explosion taking place likely to injure them ; they were 600 yards from the fire.

It does not seem possible in the first nine cases, that fire-damp could have entered the air currents in such volume as to have made the explosions possible without the officials or workmen observing it.

In Nos. 1, 2, 3, 4, 5, 6, 7, 8, and 9, a shot was fired, and was the point of origin of the explosions ; had fire-damp been present in the air current in sufficient quantities to make the explosions possible through its agency alone, it is highly improbable that any shot would have been fired. In the collieries where the ten explosions given in the table, occurred, safety lamps only were used at the working face, and in some of them also on the intake air ways, therefore we must go to other explosions for a condition which supplies a negative reason why fire-damp is not the principal factor in some large explosions.

In many mines worked entirely, or nearly so, with naked lights, a great explosion has swept over the whole pit. Scotland affords an example of this in the explosion at Blantyre in the splint coal. It does not seem possible that any great area of a seam in which naked lights are scattered here and there could be so charged with fire-damp as to render an extensive explosion possible. A sudden fouling of the air current from any cause would lead to an explosion at the first open light encountered, and so would limit its extent. Yet at Blantyre, Clifton Hall in Lancashire, and Llanerch in Monmouthshire, and in many other cases, the mines were working with open lights, and all at once an explosion traversed the whole seam, causing in the cases just mentioned the death of 207, 178, and 176 persons respectively.

On exploring the mines after the occurrence of the explosions given in the table, there was no evidence of any outburst of gas or failure of the ventilation to account for the presence of fire-damp in sufficient quantity to cause the explosions. In No. 9 a single issue of fire-damp could have explained the explosion. In the other cases the course taken by the blast could not be explained by supposing that fire-damp had entered the air current at any particular point ; on such an assumption roads that should have been traversed were missed out, and roads were traversed that should have escaped. By no reasoning could the explosions be ascribed with any degree of probability to fire-damp only.

The positive reasons that support the view that coal dust was the principal factor in these explosions are as follows :—

The intake air ways were in all the cases, except No. 9, also used as haulage roads. In Nos. 1, 2, 3, 4, 6, 7, 8, and 10, mechanical haulage was in use on these roads, the main and tail rope system in all except No. 7, where the endless chain was in use. In No. 5 horses were employed. These roads were dry, they were traversed by large currents of air, and coal dust was blown off the trains of laden hutches passing often at high speeds, in the opposite direction to the air current. The result was that fine coal dust accumulated on the roof and sides, as well as coarser dust on the floor. Near the downcast shafts coal dust, carried down with the air from the screens, assisted materially in forming these deposits. The writer has not seen a road in a colliery in Scotland containing so much of the upper or wind-borne dust as occurs on similar roads in the dry mines of the north of England. These dust-laden, intake air roads were the roads principally affected by the explosions, and, as already stated, in Nos. 1, 2, 4, and 7 the explosions were entirely confined to them. In Nos. 1, 2, 4, 6, 7, and 8, the explosions originated on them.

The inner portions of the haulage roads, where the laden hutches, drawn by horses and ponies moved at slower speeds against feebler currents of air, contained little of the upper dust, and often the coal dust on the floor was much mixed with stone dust. The explosions were often checked on reaching such points.

In some cases, however, where these roads and the working face contained a considerable quantity of coal dust they were traversed by the explosions.

The explosions were in many cases stopped by damp ground. This was specially noticeable with regard to the explosions which extended to the downcast shafts, which was the case in Nos. 2, 3, 4, 5, 6, 7, 8, and 10. Where the downcast shafts were wet the explosions were arrested and did not cross them. In No. 2 the shaft was dry, and the explosion crossed it. In No. 3 the downcast shaft was very dry, and the explosion entered it and extended upwards to the surface, and downwards to four levels below. A dampness in the floor, it was observed, was not sufficient to arrest an explosion if upper dust existed.

In Nos. 3, 5, and 9 short lengths of the return air ways were affected principally next the working face where coal dust was present in quantity greater than is usual in such roads. The return airways on the whole could be said to be free from coal dust, and were not so dry as the intake air ways. At Altofts the return air ways were used as travelling roads for the colliers, and were full of stone dust ground up from the floor of the seam.

If the explosions were caused by the combustion of coal dust, the absence of alarm on the part of the workmen can readily be understood. The mines were in their normal state up to the moment of the explosion, and there was no new condition present calculated to cause alarm.

Naked lights could be in use all over a dusty mine and be a source of no immediate danger, although the necessary elements for propagating an explosion in the shape of coal dust resting on the floor, roof, and sides, and pure air were everywhere present.

The fact that some of the explosions were originated by the firing of a shot, is strong evidence that the air current was not in an explosive condition from the presence of fire-damp alone where the shots were fired, and affords some presumption that coal dust, either alone or in conjunction with such a proportion of fire damp as not to be considered dangerous by the person igniting the shot, was the agent first inflamed, as the danger of coal dust is not understood.

The personal experience of the writer points strongly to the preponderating influence of coal dust in large colliery explosions. How far this may be true for other large explosions, it is in many cases now almost impossible to say. Until a few years ago coal dust was not recognized as a factor in these disasters and in published accounts of earlier explosions, it is only mentioned incidentally. The explosions were always referred to fire-damp, and theories to account for its presence in sufficient quantity by a sudden outburst, the leaving open of ventilating doors, or some other cause, were put forward with more or less confidence.

There are, however, so many points of resemblance between the explosions briefly described and most other large explosions that the writer does not hesitate to express the opinion that in almost all widespread explosions the influence of coal dust has been predominant.

It is not, however, probable that so large a proportion of other large explosions have been caused by coal dust in air practically free from fire-damp being the agent first inflamed, as in the cases tabulated. Fire-damp ignited by the flame of a naked light or safety lamp or a mixture of coal dust and air containing a small percentage of fire-damp ignited by the flame of a shot, have probably been the origin of most large explosions.

The experimental investigation of the influence of coal dust in colliery explosions has been undertaken by individuals, committees, and Government Commissioners, both at home and abroad.

(*) This explosion, as well as Nos. 2, 3, 4, 5, and 6, in Table 1., are described in detail in a book entitled "Explosions in Coal Mines," prepared by Mr. W. N. Atkinson and the writer.

Mr. H. Hall, H. M. Inspector of Mines for the West Lancashire District, and Mr. Clark, mining engineer, described in a paper read before the North of England Institute of Mining Engineers, in June, 1876, some experiments they made with coal dust in a mine from the surface. The mine was 45 yards long, and 30 feet sectional area. They scattered coal dust on the floor and fired a cannon at the face to represent a blown-out shot. The most decisive result obtained by them may be given in their own words :—

"Coal dust having been scattered on deals the whole length of the slant (the thill being very wet), fired 2½ lbs. powder: in this case flame issued strongly at the mouth of the slant, having travelled 45 yards. The blast was very fierce and would certainly have proved fatal to any one struck by it in its course."

In 1890 Mr. Hall experimented by firing a small cannon at the bottom of shafts after coal dust had been emptied into them, and caused explosions extending to the surface, or in one instance 180 yards.

These are the only experiments on a large scale in Great Britain.

Mr. Wm. Galloway, who was probably the first to recognize the great influence of coal dust in large explosions, has conducted and published the results of many experiments on a small scale, in which he demonstrated the inflammability of coal dust. The Chesterfield and Derbyshire Institute of Engineers conducted experiments on a small scale, but obtained no very definite result, and appear to have been led by the negative results obtained to underestimate the importance of the question.

Sir F. A. Abel carried out experiments with coal dust on a small scale, at the request of the Home Secretary, in connection with the enquiry into the Seaham colliery explosion (No. 2 in list). He obtained no decisive result as regards the inflammability of coal dust and air alone, but he discovered, as already mentioned, the effect of dust, as dust and apart from its inflammability, in promoting the inflammation of mixtures of fire-damp and air.

He also conducted some experiments in larger galleries with coal dust and blown-out shots, which showed that coal dust "will feed the flame projected by a blown-out shot so as to carry it on to a comparatively considerable distance."

The most important experimental work in connection with this question is that of the Prussian Fire-damp Commission, a translation of whose report will be found in vol. 34 of the Transactions of the North of England Institute of Mining and Mechanical Engineers.

The experiments were made in an elliptical gallery, 167·3 feet long, and having a sectional area of 17½ square feet. A side gallery 32·8 feet long was added to the main gallery at a later period. Shots were fired at one end of the gallery from cannons to represent blown-out shots. The Commission sum up the result of their labours at considerable length. They state :—

1—"The *presence of coal dust* in more or less abundance in the immediate vicinity of the working face, *gives rise to more or less considerable elongation of the flame* projected by a blown-out shot, *whether small quantities of fire-damp be present in the surrounding air or not.*

2. *a*—"*In the complete absence of fire-damp the elongation or propogation of flame is generally of limited extent*, however far the deposits of dust may extend in the mine ways.

b—"*There are, however, certain descriptions of coal dust which*, if ignited by a blown-out shot, will not only *continue to carry on the flame, even to distances extending considerably beyond the confines of the dust deposits*, but will also *give rise to explosive phenomena or results in the complete absence of any trace of fire-damp* which, in character and effects, are similar to those produced with some other dusts in air containing 7 per cent. of fire-damp.

3. *a*—"*All the phenomena produced by the burning of and propagation of flame by coal dust are intensified by the presence in the air of small proportions of fire-damp.*

b—"*Certain dusts* which, under favourable conditions, appear to have the power of propagating flame to an indefinite extent in a dust-laden area, the air being free from fire-damp, *will, if only sparsely suspended in air containing fire-damp in some proportion below 3 per cent., render such a gas-mixture susceptible of explosion by a blown-out shot.*

4—"Special experiments, in which the branch gallery, described as opening into the main gallery near its extremity, was charged with a fire-damp mixture (retained by brattice cloth), demonstrated that *a coal dust ignition or explosion developed in the complete absence of fire-damp, can communicate ignition to an explosive gas-mixture existing at a very considerable distance from the point of first ignition.*"

The Royal Commission on Explosions from Coal Dust in Mines, now sitting, will probably experiment on a large scale. From the volume of evidence issued by the Commission it appears probable that an artificial gallery, 200 yards in length, will be erected. This length will not be sufficient to test all the questions that arise. The writer's suggestion to the Commission was that some experiments should be made in a gallery not less than half a mile long.

From actual observations in mines it appears that a coal dust explosion proceeds from 50 to 100 yards from the point of origin before developing its maximum force. It is doubtful if this can be illustrated in a gallery 200 yards long. The arresting of a coal dust explosion, travelling with maximum force and velocity, by a space free from dust, could not be tested in such a gallery.

Remedial Measures.

The first step in this direction is to obtain a proper conception of the causes of explosions in mines. The danger arising from fire-damp is well known, and also the precautions necessary to prevent its accumulation and ignition, such as sufficient ventilation and the absence of naked flame. The danger of coal dust is not so generally understood or admitted, but it is hoped that this will be secured by the labours of the Royal Commission now sitting.

The danger arising from coal dust in mines may be met (1) by precautions to prevent its ignition, and (2) by the adoption of means to prevent its accumulation or to render it innocuous.

The formation of a cloud of coal dust in mines and its subsequent ignition is practically caused by the disturbance and flame attending the explosion of shots or of mixtures of fire-damp and air; both of these will, it is believed, under some conditions, raise and inflame a cloud of coal dust in air, and initiate a coal dust explosion which becomes self-supporting.

Most shots are fired at the working face, and in mines deep enough to be dry and dusty some fire-damp is nearly always present in the air in such situations, and fire-damp may be liberated by the shot: the coal dust, however, is confined to the floor, and is not so fine as the wind-borne dust on main haulage roads. At the working face a blown-out shot fired near the floor, or pointing to the floor, is most dangerous, and the dust must be present in considerable quantity before a coal dust explosion is possible, and then the effect of the probable volume of fire-damp present in the air is to be considered.

On main haulage roads, after their completion, it must be noted comparatively few shots are fired, and where fire-damp is practically absent coal dust of the finest character is often found on the roof and sides, as well as coarser deposits on the floor, and strong currents of air are usually present to sustain any cloud formed.

The effect of a shot in disturbing dust on such roads is two-fold. The powder gases rushing from the shot agitate the air in its vicinity, and shock or tremor is communicated to the solid sides of the passage. At the working face, the first cause only operates. Any tremor given to the floor on which the dust there rests would have no effect in raising a cloud; but where dust is on the roof and sides as well as on the floor, both causes assist in forming a cloud.

The combined effect of these conditions appear to make it much more dangerous to fire a shot on an old haulage road, where there is much dust, than at the working face. Nos. 1, 2, 4, 6, 7 and 8 explosions were, it is believed, caused by shots which were not blown out, fired in stone on old intake and haulage roads where the air was practically free from fire-damp.

Nos. 5 and 9 explosions were caused by shots fired in stone at the working face. In these cases there was an unusual quantity of coarse dust on the floor near the shots, and there would probably be from 1 to 2 percent of fire-damp in the air. In No. 5 the position of the shot hole could not be determined; in No. 9 the shot was partially blown out, and pointed to the floor.

The raising of a cloud of coal dust by shots may be prevented by removing or damping the dust in their immediate neighborhood, as is required by the present Mines Act, without resorting to any general system of removal or damping.

The use of a flaming explosive in conjunction with some material to kill the flame, or the use of a flameless explosive (if such exists) are remedies adopted.

The danger arising directly from explosions of fire-damp and air is a sufficient reason for adopting every reasonable precaution to prevent their occurrence. In dusty mines, where such explosions may be indefinitely extended by coal dust, even greater precautions are necessary.

No. 3 explosion was probably originated by a local explosion of fire-damp at an open light; No. 10 was caused by fire-damp ignited by the flame of a fire. The fire-damp had collected in passages near the working face, from which the air current had been cut off by the erection of a stopping in the intake in order to isolate the fire, the initial explosion so cause being extended to the downcast shaft by coal dust.

Means to prevent the formation of dust deposits, or to render them innocuous, will be briefly glanced at.

Main roads are watered on the floor, and in some cases mechanical sprayers are used, so as to damp the roof and sides as well. Water pipes are laid along the main roads, the water issuing under pressure as a fine jet at intervals. Compressed air is used in connection with the water so as to secure a fine spray, and both damp the roads and saturate the air current with moisture.

In some cases the water pipes are simply provided with cocks at intervals, to which a hose pipe is attached when watering is necessary.

List of explosions causing loss of life resulting from the ignition of fire-damp and coal dust in the collieries and Mines in the United Kingdom under the various Coal and Ironstone Mines Regulation Acts.

Year.	Number of Explosions, arranged according to Loss of Life.											Total No. of Explosions.	Total Lives Lost.
	1	2	3	4	5	6	7	8	9	10	11 or more Lives—Each Explosion given separately.		
1851	70	12	5	5	—	1	1	—	2	—	13, 35, 52, 61	100	321
1852	70	10	—	3	1	2	—	—	—	1	12, 22, 36, 65	91	264
1853	53	12	2	1	2	1	—	—	—	1	11, 20, 58	75	202
1854	62	9	4	3	—	2	1	—	—	—	89	82	212
1855	65	17	5	3	1	—	1	—	—	—		92	138
1856	54	8	3	1	1	—	—	—	—	—	11, 11, 12, 114	71	236
1857	43	13	5	5	1	—	—	1	2	—	13, 40, 189	73	377
1858	44	10	8	3	—	1	—	—	—	—	12, 19, 25, 53	70	215
1859	53	10	3	2	1	—	—	—	—	—		69	95
1860	47	8	7	—	—	—	—	—	—	—	12, 13, 13, 22, 76, 142	68	362
1861	45	12	—	1	—	—	1	—	1	1	13, 13	63	125
1862	49	5	1	1	—	1	—	—	—	—	16, 47, 59	60	194
1863	42	11	1	2	—	1	—	—	—	—	13, 15, 26, 39	61	173
1864	48	13	4	1	1	—	1	—	—	—		68	102
1865	44	7	8	3	1	—	—	1	—	—	26, 34	66	167
1866	47	14	1	3	—	—	—	1	—	—	12, 24, 27, 30, 38, 91, 334	73	654
1867	41	9	7	—	—	—	1	—	—	—	12, 14, 178	61	291
1868	36	5	1	1	—	—	—	1	—	1	26, 62	47	159
1869	32	5	2	2	1	1	1	—	—	—	11, 27, 37, 53, 59	49	261
1870	38	13	3	1	1	1	—	—	2	—	19, 19, 20, 30	63	193
1871	29	9	—	3	1	1	—	1	1	—	19, 26, 26, 38, 70	50	266
1872	52	4	2	1	—	1	—	1	—	—	11, 27, 34	64	156
1873	28	8	—	2	1	2	2	—	—	—	18	44	101
1874	33	6	—	2	1	—	—	—	—	—	15, 17, 23, 54	46	167
1875	24	6	2	2	1	—	1	—	—	—	16, 23, 43, 143	40	287
1876	26	10	3	1	2	1	—	—	—	—	23	44	98
1877	35	3	1	1	—	—	—	1	—	1	18, 18, 36, 207	46	345
1878	17	5	3	—	—	1	1	—	—	—	17, 23, 43, 189, 268	32	589
1879	21	5	2	—	2	2	1	1	—	—	21, 28, 63	37	186
1880	14	4	—	2	—	2	—	—	1	—	62, 101, 120, 164	27	498
1881	24	4	—	1	—	—	—	1	—	—	25, 48	32	117
1882	19	4	1	4	1	—	1	—	—	—	13, 32, 37, 45, 74	35	259
1883	15	4	1	1	1	2	—	—	—	—	20, 68	26	135
1884	21	4	2	—	—	—	1	—	—	—	14, 14	30	70
1885	17	3	—	—	—	—	—	1	1	—	42, 81, 178	25	341
1886	12	2	1	1	—	—	—	1	—	1	22, 28, 38	21	129
1887	13	3	5	—	—	—	—	1	—	—	39, 73	24	154
1888	11	1	1	—	1	—	—	—	—	—	30	15	51
1889	8	4	2	1	—	1	—	—	—	—	20, 23, 64	19	139
1890	16	3	—	—	1	—	—	—	—	—	87, 176	22	290
1891	12	8	1	—	—	—	—	—	—	2		23	51
Totals	1430	303	97	63	23	24	14	12	10	8		2104	9172

11 (5)	20 (4)	30 (3)	42 (1)	59 (2)	74 (1)	142 (1)
12 (6)	21 (1)	32 (1)	43 (2)	61 (1)	76 (1)	143 (1)
13 (8)	22 (3)	34 (2)	45 (1)	62 (2)	81 (1)	164 (1)
14 (3)	23 (5)	35 (1)	47 (1)	63 (1)	87 (1)	176 (1)
15 (2)	24 (1)	36 (2)	48 (1)	64 (1)	89 (1)	178 (2)
16 (2)	25 (2)	37 (2)	52 (1)	65 (1)	91 (1)	189 (2)
17 (2)	26 (5)	38 (3)	53 (2)	68 (1)	101 (1)	207 (1)
18 (3)	27 (3)	39 (2)	54 (1)	70 (1)	114 (1)	268 (1)
19 (4)	28 (2)	40 (1)	58 (1)	73 (1)	120 (1)	234 (1)

At some collieries the laden hutches are watered at the engine landings. More attention is paid to the construction of the hutches, so as to prevent coal and coal dust being shaken out of them.

By the use of steam the temperature of the air descending the downcast shaft has been raised to the temperature of the mine and at the same time saturated with moisture; the air current passing around the mine then ceases to have any drying power.

Hygroscopic or water-absorbing salts have been sprinkled on the roads to secure dampness.

Coal dust from the screens on the surface should be prevented as far as possible from descending the downcast shaft with the air current.

The above table shews the number of fatal explosions due to fire-damp and coal dust, and loss of life occasioned thereby, as registered in the reports of the Inspectors of Mines, from the year 1851 to 1891, both inclusive. There are 2,104 separate explosions, causing the loss of 9,172 lives, the average death rate per explosion being 4·36.

It has occurred to the writer that some argument in support of or against the coal dust theory may be founded on these figures.

It will be observed that the number of explosions causing the loss of one life is 1,430, of two lives 303, and so on to the final explosion causing the loss of 334 lives. The rate of decrease of the number of the explosions, as the rate of their fatality increases, is shown in a diagram (Plate I.) The number of lives lost by an explosion is, roughly speaking, in proportion to the area of the field of the explosion.

Is the curve shewn in the diagram such as might be expected if the explosions were all due, or nearly so, to one cause—the explosion of fire-damp and air? If this can be answered in the negative, can the curve be explained on the assumption that there are two causes, the other being coal dust?

Three assumptions may he made with respect to these figures and the diagram founded thereon:—

1st—That the explosions are all due to fire-damp.

2nd—That the explosions are all due to coal dust.

3rd—That the explosions are due to both agents.

The first assumption—that the explosions are all due to fire-damp—has been held until recently, and is still held by some persons, modified by the admission that coal dust has aggravated or intensified some explosions. On this assumption there appears to be some difficulty in explaining the diagram. Why should there be such an extremely rapid decrease up to a certain point of the number of the explosions as their fatality increases? If fire-damp is the cause of the large number of small explosions causing one, two and three deaths, and also of the monster explosions, might not a considerably greater number of intermediate explosions have been anticipated. A reason that might be suggested is, that the use of safety lamps renders a large explosion possible in some mines by enabling a great length of air current to become explosive before it is ignited, while the use of naked lights in other mines causes the large number of small explosions. The explosions causing the loss of one life are undoubtedly nearly all due to fire-damp; this the writer can state from investigation of a large number of them. Had mines been free from coal dust probably the line in the diagram would have been terminated sooner; as the rate of fatality increases, so it is believed does the influence of coal dust.

The second assumption is clearly untenable. Many explosions occur in mines free from coal dust, such as damp coal mines, oil shale, ironstone, and occasionally in lead mines; it may be noticed, however, that in such mines large explosions do not occur. If coal mines had been free from fire-damp, the dust remaining the same, probably the line in the diagram would have been nearer a straight line.

On the third assumption the diagram may be explained bearing in mind the following facts:—Fire-damp is readily ignited, and as many mines yielding it in small quantity are worked with naked lights, local explosions due to it are not unfrequent. On the other hand the danger of fire-damp is well known, and if present in large quantity suitable precautions are taken. Coal dust is not readily ignited, and in the past no precautions have been thought necessary with regard to it, but if it is once inflamed it is likely to cause a large explosion, because it is present in dry mines continuously over wide areas, and in many large explosions the loss of life has been practically that of the miners underground.

The Ventilation of Fiery Mines.

(Paper by M. RATEAU, before the Societe Minerale de Saint-Etienne.)

Fire-damp gets into the mine in three different manners—while the coal is being got; by blowers; and by irruption of air from the old workings.

Disengagement of Gas from the Working Face.—Some coals disengage as much as twenty times their volume of gas; and, according to the nature of the coal, sometimes this disengagement is very rapid but at others slow. Sterile rock also disengages fire-damp, which is sometimes met with in salt and metalliferous mines, and even in quarries. While for a certain small extent of a given seam the disengagement of gas may be tolerably regular (except in the case of sudden outbursts), this is by no means the case under the following circumstances:—

Issue of Fire-damp by Blowers.—When the piercing of a cavity gives rise to a blower, which is greatly to be feared in the neighbourhood of faults, and also when mining operations in a lower height of workings disturb the equilibrium of measures at the sole of the upper height.

Irruption of Air from Old Workings.—When, in old workings, however well they may be gobbed, vacant spaces are left in which the gas may continue to be disengaged, long after working has ceased. Although old workings do not generally contain much gas, one cannot be sure that they do not. Gas from old workings may burst out in others being carried on, in two different manners—viz., by a general lowering of pressure in the mine and by a modification of the *regime* of the ventilation. As variation of the pressure in a mine, caused either by change in the external atmosphere or in the speed of the fan, is very slight and does not take place suddenly, this is not so great a cause of danger as the second, stated as follows by M. Rateau: "The old workings generally communicate with those in active operation by several orifices, so that an air-current is almost always set up, and sweeps away the accumulations of gas which have a tendency to form there. This is why they may not contain fire-damp. But such a *regime* of ventilation may be so set up that the pressures at the orifices of the old workings may be exactly balanced, when the air, having no longer a tendency to pass out, remains stagnant, and becomes charged with gas if any more be disengaged."

Ventilation Regime.—Variations in the *regime* of ventilation, occurring under these circumstances, brings about changes in the distribution of pressures at the orifices, and an air current is established on one side or the other, so that very soon all the air in the old workings, or nearly so, bursts into the workings in operation, and the danger becomes grave. Many accidents in but slightly fiery mines may perhaps be traced to this cause, for which an exceptional concatenation of circumstances is necessary; so that the precept should always be observed that *the ventilation regime of a mine should only be changed progressively and with precaution.*

Opinions differ as to whether it is best to wall up orifices communicating with old workings, or to ventilate them constantly so as to prevent accumulations of gas; and the Austrian Fire-damp Commission recommends that the lower orifices be stopped up, and the higher left open, so as to permit the gas to pass into the return air-current.

Classification of Fiery Mines.—While in France all fiery mines are subject to the same regulations, which is a simple mode of dealing with the question, though one open to numerous objections, the Austrian Firedamp Commission classifies them as: (1) Slightly fiery, which have less than 1 per cent. of gas (fire-damp and carbonic acid) in the return air ways ($\frac{1}{10}$ cubic metre per second and per ton of coal got in twenty-four hours); (2) fiery, with from 1 to 2 per cent of gas; and (3) very fiery, with more than 2 per cent. Until exhaustive experiments shall establish a law for each mine, the author thinks it safest to keep to the present French system.

To be well rid of fire-damp it is indispensable to resort to mechanical ventilation, and three different methods may be employed for getting rid of fire-damp. Absorption of the gas by re-agents is impracticable, and drawing it off by pipes is difficult and not to be recommended, except in the case of blowers. The only really efficacious method of dealing with gas is to dilute it with a sufficient quantity of fresh air to render it harmless, and then draw it out of the mine; but the current must be judiciously distributed, so as to oblige the gas to mingle with the air employed to draw it off.

Necessity for Mechanical Ventilation.—Efficient ventilation should (1) circulate a sufficient volume of air to dilute the gas, (2) distribute the current and (3) oblige the gas to mingle with the air.

Volume of Air to be Circulated.—Since the inflammability of the mixture of gas and air only begins with a proportion of 6 per cent. of gas, it would theoretically be sufficient to circulate through the mine a little more than sixty-four times the volume of gas divided by six; but practically much more is required—first, on account of the dust, which increases the inflammability, and secondly, because a co-efficient of safety is necessary, on account of variations in the disengagement of gas and defects in the district of the air current. The same co-efficient of safety as that adapted for iron bridges—viz., 1 : 5 to 1 : 6—is generally admitted by fire-damp commissions, which recommend that there should never be in the return air ways a greater proportion of combustible gas than from 1 to 1·5 per cent.; but a mine with 1 per cent. of gas in the return air ways is certainly in a precarious condition, and there is every reason to reduce it below 0·5 per cent. A study of the return air in a mine and its variations may now be made easily and with sufficient correctness by means of the Pieler lamp and the Shaw grisoumeter; and this study, rather than the number of men or the quantity of coal raised, should serve as a basis for calculating the total quantity of air to be sent into the workings. In many cases this quantity is much greater than that obtained by simple natural ventilation, which is always insufficient when the seasons change; it is therefore, absolutely necessary to employ mechanical means for ventilation.

Distribution of the Air Current.—It is important that the air current search out and draw away the gas from all the nooks and corners of the mine; and the quantities to be sent into each part or place should equal the quantity of gas evolved from it. Besides the difficulty of ascertaining this quantity, there is that very complicated one of the manner in which the distribution can be effected. It is indispensable to have a stable distribution; wherefore the difference of pressures at the entrance and exit must be sufficiently great for differences of temperature underground not to reverse or even slacken the air currents. It is not sufficient for effective ventilation to have volume merely, there must also be a marked difference of pressure, which should not be less than 25 or 30 mm. (1 in. to 1⅜ in).

Great care should be taken in modifying a *regime* long established, for a change introduced at a given point may exert its influence a long way off, and upset the ventilation of districts apparently removed from its influence. The use of secondary ventilators underground, as in the Blanzy colliery, is calculated to render great service, not only in the case of *cul de sac* workings, but also in certain districts that may with difficulty be put into communication with the general air current. In this way it is possible in order to avoid any awkward strangling of the main air ways to oblige the air current to make a complicated circuit through the action of the main fan.

Energetic Ventilation.—It follows that for fiery mines intense mechanical ventilation is required, giving as large a volume as possible with a considerable difference of pressure; and this is the conclusion arrived at by most fire-damp commissions, though it would appear that a contrary opinion prevails at Saint-Etienne. The opinion that mechanical ventilation is bad and that a large volume of air is not advisable is condemned beforehand by the many disasters in that district, especially during the last few years, all of which accidents have, without exception, occurred in mines with natural or feeble ventilation.

Necessity of Mingling the Gas with Air.—It is with great difficulty that fire-damp mingles with air on account of its extreme lightness. The ratio between the density of air and fire-damp—viz., 7 : 1—is greater than that between air and carbonic acid: (1 : 5); and it is well known (Grotto del Cane) that the latter gas remains a long time on the floor of workings without mingling with the air. In the same way does fire-damp rise to the roof, collect in cavities, and stay there, strong air-currents not being able to dislodge it. As it is not always possible to avoid leaving cavities, M. Rateau recommends the use of portable fans, provided with flexible hose and nozzle, for dissipating accumulations of gas. Each of these tertiary (*de troisieme ligne*) ventilators would be wheeled about the mine by two men with the sole object of dissipating accumulations of gas.

Principal Ventilator.—The main fan may be either pressure or exhaust. The necessity for an upward current and of erecting the fan over a shaft not used for winding, generally leads to the exhaust system being employed; and, wherever that arrangement is not obligatory, the author is of opinion that the pressure fan should be preferred for the following reasons: Its first cost is less, it is easier to inspect, it chokes less readily and requires less frequent cleaning, besides requiring less force to drive, because the volume of air sent down is on an average 15 per cent. less than that brought up. Sometimes, especially in collieries subject to underground fires, reversible fans are put down; and this is a practice that M. Rateau considers recommendable if the fan be not required to work equally well in both directions, and if one (the exceptional) mode of action may be sacrificed.

During the last few years, in order to keep the mouths of the downcast and upcast shafts perfectly clear for winding, so as to secure a large output, fans have been erected underground. As an air lock is always required, there is no greater difficulty in arranging it on the surface than underground, while the expense in the former case would certainly not be greater. But a strong reason for never putting underground so essential an apparatus as a fan is that its inspection is in that case difficult and necessarily incomplete, while if an accident happen, the fan would certainly be injured, thus rendering it impossible to quickly re-establish the ventilation. The first underground fan was erected at the Shamrock colliery, in Westphalia; but the manager is so strongly impressed with the disadvantage of this arrangement that he has determined never to adopt it again.

Secondary Ventilators are worked by hand or compressed air engines, the latter being manifestly preferable, and in this case they are generally pressure fans. The author, however, considers that there are many cases in which it would be preferable to employ exhaust fans, on account of the difficulty of obliging the gas to mingle with air. Thus, instead of sending a current of fresh air against the working face of a level, it would be better to exhaust from a point a little in front of the face and near the roof, by a pipe suspended from the horizontal members of the timbering. As the current of fresh air would traverse the whole working, the latter is less exposed; and besides, the air, continually rising towards the orifice of the pipe, would draw along with it all the gas which it encountered, and which, therefore, would be drawn away. With the insufflation method, on the contrary, the gas disengaged from the face, drawn along by the air but not completely mingled with it, would soon become to a certain extent separated from it and remain in the spaces between the horizontals of the timbering. By placing the pipe in the upper part of the working there is also the advantage of arranging short branch pipes at intervals, for keeping up a constant circulation in the cavities. Even leakage in the main pipe would, to a certain extent, exert this effect. Another case in which exhaust fans are preferable is that in which the smoke from shots has to be drawn off. By exhausting the smoke it goes off through the pipe, and the air of the working is soon purified, whereas this is far from being the case with a pressure fan.

Tertiary Ventilators.—What M. Rateau calls *ventilateurs de troisieme ligne*, already referred to, are intended for dispersing accumulations of gas. Very small fans may be usefully employed to dislodge gas from cavities by air jets, and also to disperse accumulations in *cul-de-sac* mines temporarily abandoned, in which case the exhaust

fan is clearly indicated, though it should be used with precaution. In the first place such a working should not be cleared of gas all at once, because there would be danger, (as happened last year at Firminy) of causing an accident by vitiating the whole return air current. Besides, the gas does not mingle completely with the air; but a large part rises to the roof and fills all the spaces between the timbering. To obviate this source of danger the gas must be mixed with a sufficient quantity of pure air before allowing it to pass into the general current, so that, according to M. Favet, the difference of densities becomes so slight that gas has no longer a marked tendency to rise to the roof. This is practically carried out by M. Rateau's combined exhaust and pressure fan, that causes an intimate mixture of air and gas, which mixture may be led by a delivery pipe wherever desired. In the original paper a table of the results obtained by this apparatus is given which will draw 50 titres (176½ cubic feet) of gas per second and mix it with five or six times its volume of air.

Comparison between Fans and Furnaces.—The author demonstrates by mathematical formulæ that fans are much more economical than furnaces, and from his deductions compiles a table from which it appears that, at all depths of working, fuel consumption is much less for the former than for the latter, the difference being as 1 : 5 at a depth of 300 m. This is even greater where steam that has to be generated in a boiler—the first cost of which must be taken into consideration—is used instead of a furnace.

Ignition of Mine Shots.

(Colliery Guardian).

M. Janet opens his remarks on this subject in the *Annales des Mines* by observing that, if shots in fiery mines are not the most frequent cause of accidents, they, at any rate, lead to the greatest number of victims, while the labours of the French Explosives Commission, and especially the discovery (by M. Mallard and M. Le Chatelier) of new explosive substances capable of detonating, without igniting fire-damp, had done great service to the mining interest, and had also rendered the working of fiery mines much less dangerous.

As a consequnce of these labours a ministerial circular called upon the Prefects (chief administrative officers of the departments) to make obligatory the use of the new explosives, not only in fiery mines but also in those the dust of which is inflammable, while at the same time providing that the temperature of detonation shall not exceed 1,900 degs. Cent. in rock, nor 1,500 degs. Cent. in coal.

But, contends M. Janet, there is danger of igniting the gas, not only when the explosion takes place, but also when the fuse is lighted; and it is just this matter, so long neglected, wich constitutes a serious source of danger. In fact, except in a few collieries where shots are fired by electricity, the so-called safety fuse is used, ignited by *amadou*, or German tinder.

The French Explosives Commission pointed out the advisability of completely suppressing the use of safety fuse in fiery mines, and suggested the substitution of friction detonators and electricity. Those methods have not, however, come into general use, though some friction detonators have been used with good results. The objection to electricity, except in sinking shafts and driving large roads, is that the appliances for ignition are two heavy to be removed about easily, while currents of high tension may give out sparks capable of igniting the gas. So long, however, as the old fuse is employed there is every reason to reduce its dangers to a minimum, especially as regards the method of lighting it.

After describing the well-known "safety," the rate of combustion of which is stated to be from a metre to a metre and a-quarter per second, M. Janet gives the following as the causes by which fire-damp may be ignited by its means:—(1) By the incandescent substance used to light the end of the fuse, (2) by the sparks issuing from the end at the moment of lighting, (3) by the little explosions that the fuse may cause while burning, and (4) by the gases due to the combustion of the explosive, which appreciably precedes the detonation, when the fuse, penetrating too deeply into the catridge, is brought into direct contract with the explosive. This last cause of danger, which no appliance can prevent, has the great disadvantage of making the safety of the colliery dependent on the experience of a miner; but this disadvantage has been lessened since the firing of shots in mines subject to outbursts of gas has been entrusted to special hands.

The little explosions that may be caused by the normal combustion of the fuse also constitute a source of danger difficult to obviate; but the experiments of the French Explosives Commission have demonstrated that, if there be none of these little explosions, the mixture of air and gas is not ignited by the mere burning of the fuse, provided it be lighted outside the explosive mixture, safety, therefore, depending on the quality of the fuse. These little explosions result from two very distinct causes, viz., (1) the presence, in the central core of powder, of grains of appreciable size, and (2) insufficient strength in the outer covering. When the core is made of very fine touch-powder it burns gently at the rate mentioned above; but a single grain only will cause a slight explosion, which may burst the covering and emit flame.

All powder used for fuses should therefore be very carefully sifted, and the covering should consist of several thicknesses of material, while the best quality of fuse should always be chosen for fiery mines. The white "safety" is preferable to the black, because the tar used to coat the latter might be ignited by a little explosion. As companies cannot have the fuse inspected, as rails are, during manufacture, they should, at any rate, test ten lengths, a metre long, out of a thousand metres, by burning it in the dark; and, if the slightest explosion occur, reject the whole lot. Fortunately, the length of fuse outside the shot hole is very short, thus reducing the chance of danger, for explosions occurring inside the hole can do no harm, because of the tamping.

It is generally belived that *amadou* will not ignite fire-damp, though no direct experiment has, to the author's knowledge, determined the question; and sparks of flint and steel have been proved by the recent experiments of the French Explosives Commission to be without danger in an explosive mixture. The practice of lighting German tinder through the gauze of a safety lamp is, however, likely to cause serious danger from several causes; and so are the sparks emitted from the ends of the fuse when lighted by the tinder.

The emission of sparks from the end of the fuse projecting from the shot-hole is of short duration; and it is probable that a sufficient co-efficient of safety is afforded by admitting that the sparks do not ignite after the fuse has burnt 10 cm. (4in.) All, therefore, that is required to suppress danger from this source is to arrange a close chamber, or at any rate one enclosed by wire gauze, for lighting the fuse in such a manner as not to fire an explosive mixture of fire-damp. The appliances available for fulfilling this condition may be divided into two classes, viz., those serving for an indefinite number of lightings, and which therefore must be removed when such lighting is accomplished; and those which, serving for only one lighting, are left in place, permitting the fireman to retire at once after effecting the ignitions.

The appliances of the first category are evidently very inferior as far as safety is concerned. As it is necessary to wait until the fuse has burned 10 cm. (4 in.) before it ceases to be dangerous, and as the rate of combustion is about a metre per minute, six seconds must be allowed to elapse between the lighting and removing the apparatus; and it is too much to expect the fireman to wait so long, when any irregularity in the composition of the fuse may bring about an explosion that might blow him to atoms. Instead of counting six seconds, however, he may hold the fuse 10 cm. from the end, when he will become aware, dy the sensation of heat, that the powder has burnt up to that point. He can then remove the apparatus; and this course is preferable on account of the irregular burning of the fuse. In any case, it is necessary to leave 20 cm. (8 in.) to allow a good margin for the possibility of too rapid combustion; and this has the disadvantage of doubling the chance of a defect in the fuse occurring in that length.

M. Janet then describes at some length, and often with the aid of diagrams, several appliances which permit of lighting the fuse without the possibility—theoretically—of igniting an atmosphere impregnated with gas.

Lighting by an Incandescent Substance.

M. Lagot, a miner at Saint-Etienne, proposed, in 1881, the use of a coal impregnated with saltpetre, burning without flame. The apparatus is so arranged that when one piece of coal is burnt it will light another, thus affording an incandescent body for the whole day without touching the tube. The end of the fuse is pushed into the tube until it touches the nitrated coal. As the orifice is of the same diameter as the fuse, the flame remains enclosed in the tube, which must not be withdrawn until the fuse has burnt far enough not to be dangerous. This method was tried at the Lalle Colliery, the engineer of which concluded that it might be employed with safety by a man specially appointed for the work, but not by the miners generally. There is, however, the danger of a small piece of incandescent nitrated coal falling out of the tube and igniting the coal about the floor, while sometimes one piece of nitrated coal fails to ignite the next, and the fuse should fit tightly in the orifice, so as to prevent the former from igniting the explosive mixture.

Ignition by Chemical Reaction.

A substitute for the incandescent body may be found in two substances capable of causing, by their simple contact, a sufficient elevation of temperature to fire the charge. Messrs. Davey, Bickford, Smith and Co., of Rouen, supply a lighter, consisting of a thin metal tube, open at both ends, containing a small glass capsule with a little sulphuric acid. The capsule is closed by the blowpipe and surrounded by a piece of muslin impregnated with chlorate of potash and sugar, kept in place, on one side by a groove in the tube, and on the other by a piece of fuse, forming cushion, and leaving a sufficient length of tube free to receive the end of the fuse in communication with the shot. The other end of the tube is closed by an obturator, which permits the passage of the gases generated by the combustion of the ignition charge and of the fuse, but no sparks or flame. The fuse is fixed in the tube and the capsule crushed by a special pair of pincers, when the acid, encountering the chlorate of potash, ignites the muslin and then the powder of the fuse, thus warning the fireman to shelter. These lighters have been tried, generally with success, at the collieries of Anzin, Ferfey, Bességes and Carmaux; and though there have been misses, blowing out and bursting of the tube, which may be accounted for by an inefficient application, the author's experiments lead him to the conclusion that this appliance is calculated to render service in careful and experienced hands.

Ignition by a Fulminate.

This system, which consists in inserting the fuse in a pistol barrel and igniting it by a percussion cap, is employed at the Lens Collieries, in the Pas-de-Calais. The gunmetal barrel of the pistol is taper in form, so that the fuse can be inserted tightly. To prevent the fuse from being blown out the pistol barrel is surrounded by a cylindrical chamber to receive the gases from the explosion of the cap and the combustion of the fuse. This appliance generally answers well and makes few misses: but the fireman must not remove it until he feels by the heat that the fuse has burnt to 10 cm. (4 in.) from the end.

Ignition by the Safety Lamp.

A safety lamp invented by Messrs. Johnson and Howatt, has been experimented upon, at the request of the French Explosives Commission, by the Anzin Company, with favourable results. In order that the lamp may remain safe, it is necessary that the flame be carefully isolated from the surrounding atmosphere. The fuse is therefore introduced through a tube, which traverses the lamp from top to bottom, and is provided at the top with a cylindrical cap and a double gauze. The ignition is effected by an iron wire, 1mm. in diameter, heated to redness in the flame of the lamp and brought by a mechanical paw or finger into contact with the end of the fuse. The holes both for the wire and the fuse are provided with obturators displaced only during insertion. M. Petit, engineer at the Anzin Colliery, has proposed some modifications, including the addition of a flange to the wire. The fireman must also in this case keep the fuse in the tube until combustion has gone on for 10 cm.

Pneumatic Ignition.

This system is founded on the well-known lecture demonstration of rendering a piece of tinder incandescent by the compression of air in a close chamber; and the elevation of temperature is sufficient to fire gunpowder. An appliance depending on this principle has been devised by M. Bourdoncle, mechanic, at Decazeville, in Aveyron. There is small air pump, the piston rod of which terminates outwards in a rounded disc suitable for receiving a smart blow with the hand, to effect the compression of air. The barrel is screwed into the wide foot, in which is a central hole for introducing the fuse; and a tight joint is made by intercalating an indiarubber washer between the barrel and its foot, which washer is, by the screwing up, pressed firmly against the outside of the fuse. The foot has also a lateral hole to allow the fuse to pass and prevent it from being injured by the blow. In this case also it is necessary to wait six seconds before removing the apparatus, which has been tried at the Issards Colliery, in the Decazeville district, at the request of M. Castelnau, Ingénieur-en chief des Mines—that is, Government mining engineer of high grade—at Rodez. According to the report of M. Tarragonet, manager to the Société des Aciéries de France, to whom the colliery belongs, this simple igniter has given very satisfactory results, and has therefore been adopted in all the company's fiery mines. The blow must be a smart one to effect ignition, which is favoured by unpicking the outside of the end of the fuse, so as to expose the powder as much as possible. When these precautions are taken by one who has had a little experience with this appliance, which is easily kept in order, it makes very few misses.

While the last-named igniter, the Lagot tube, the Lens pistol and the Johnson and Howatt lamp, all have the disadvantage of obliging the fireman to stay for a few seconds near the shot to be fired, the chlorate of potash igniters permit of his retiring immediately. On the other hand the latter are expensive, owing to the high price of the chemical substance, while the maintenance of the others is insignificant, even when taking into consideration the extra length of fuse required to give a sufficient co-efficient of safety.

Coal Washing at Louisenthal.—The new coal washing floor at the Serlo colliery at Louisenthal, near Saarbrucken, commenced regular work in 1890, and experience has shown that several modifications were necessary. The very greasy character of the shale mixed with the coal presents great difficulties in the way of the clarification of the water with a view of its being used over again. After being used several times the water becomes so heavy that the jigging of the coal is interfered with. Experiments made with a view to obviate this difficulty have as yet given no satisfactory solution. The arrangement by which the coal passed from the jigging machines to the bins, by means of chutes, was also found to be disadvantageous. These chutes were built horizontal for a distance of some three yards, and the coal had to be forced along by a powerful stream of water. Consequently a large quantity of water was carried with the coal to the bins, so that the proportion of water in the lump coal was 5.32 per cent., and that in the smaller coal 6.07 and 9.01 per cent. respectively. This disadvantage has been obviated by the introduction of perforated metal band conveyors, the proportion of water being thus reduced to 3.71 per cent. in the lump coal, and to 5.03 and 6.04 per cent., respectively, in the smaller sizes.

The "Robb-Armstrong" Engine.

We illustrate on this page a new single-valve automatic engine recently brought out by the Robb Engineering Co., of Amherst, Nova Scotia. In general appearance it does not differ greatly from several popular high-speed engines, and no radical departure has been made in principles of construction, the aim being to combine as many as possible of those points which have proven best in practice, with such improvements in details as have been suggested by observation and experience with other engines. In other words, it is not an attempt to develop a new species, but to advance one step in the evolution of that already highly developed machine, the American high speed engine. The following is a brief description of the main features.

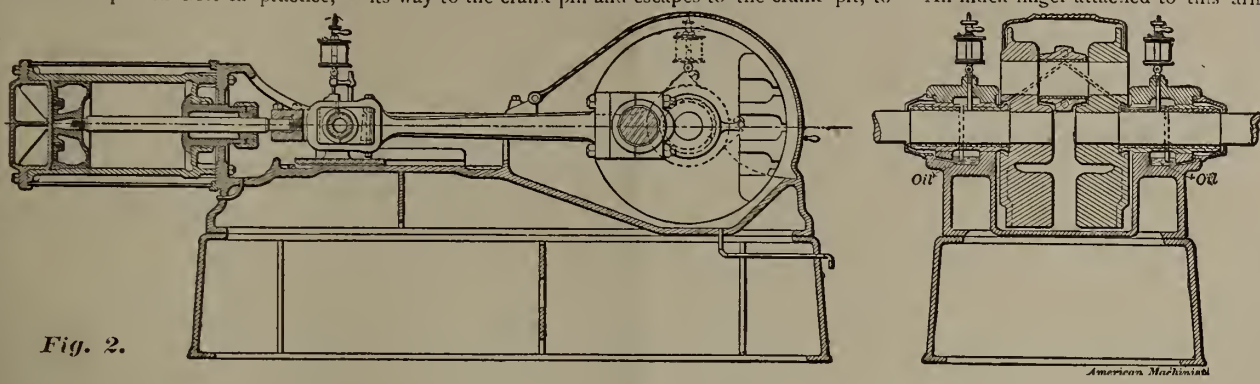


Fig. 2.

The frame is of the "Porter" type with double-disk crank; it has considerable sectional area, carried well above the centre line and is particularly thick at the top, thus bringing the metal in the direct line of strains between the cylinder and shaft bearings. The engine weighs a little over 100 pounds per horse power, not an unusual weight, but the metal is distributed to give the greatest attainable stiffness, and without much regard to the "anvil principle," the foundation being expected to furnish all the weight required in that direction at less cost.

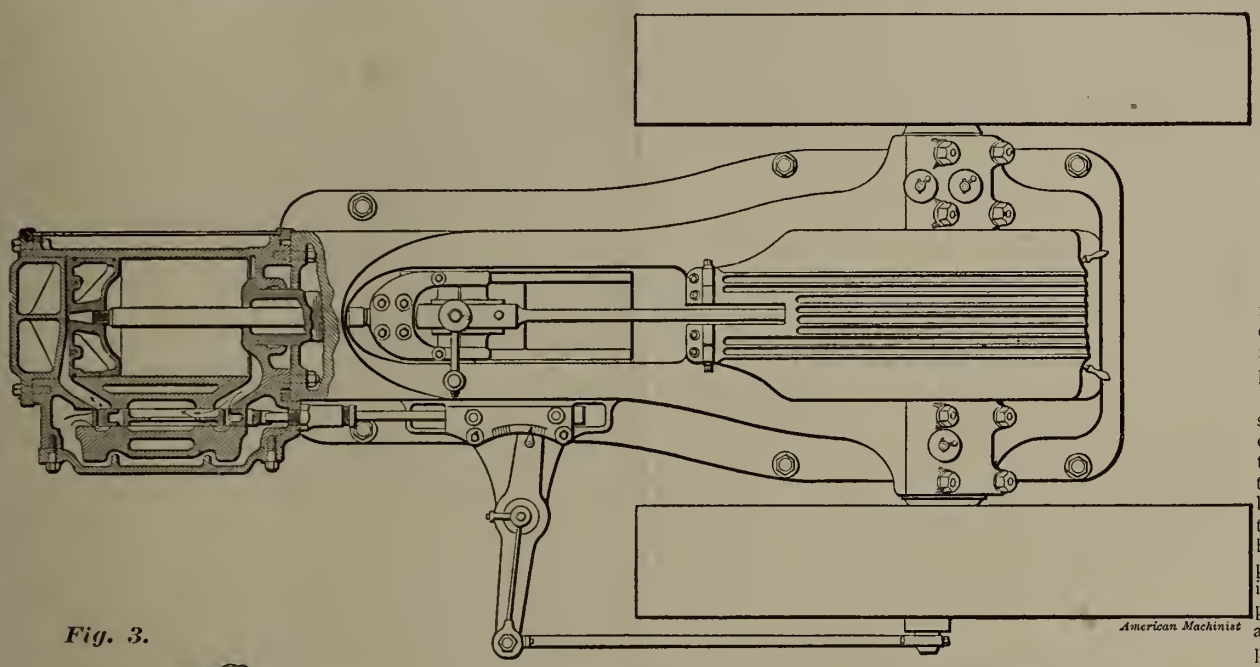
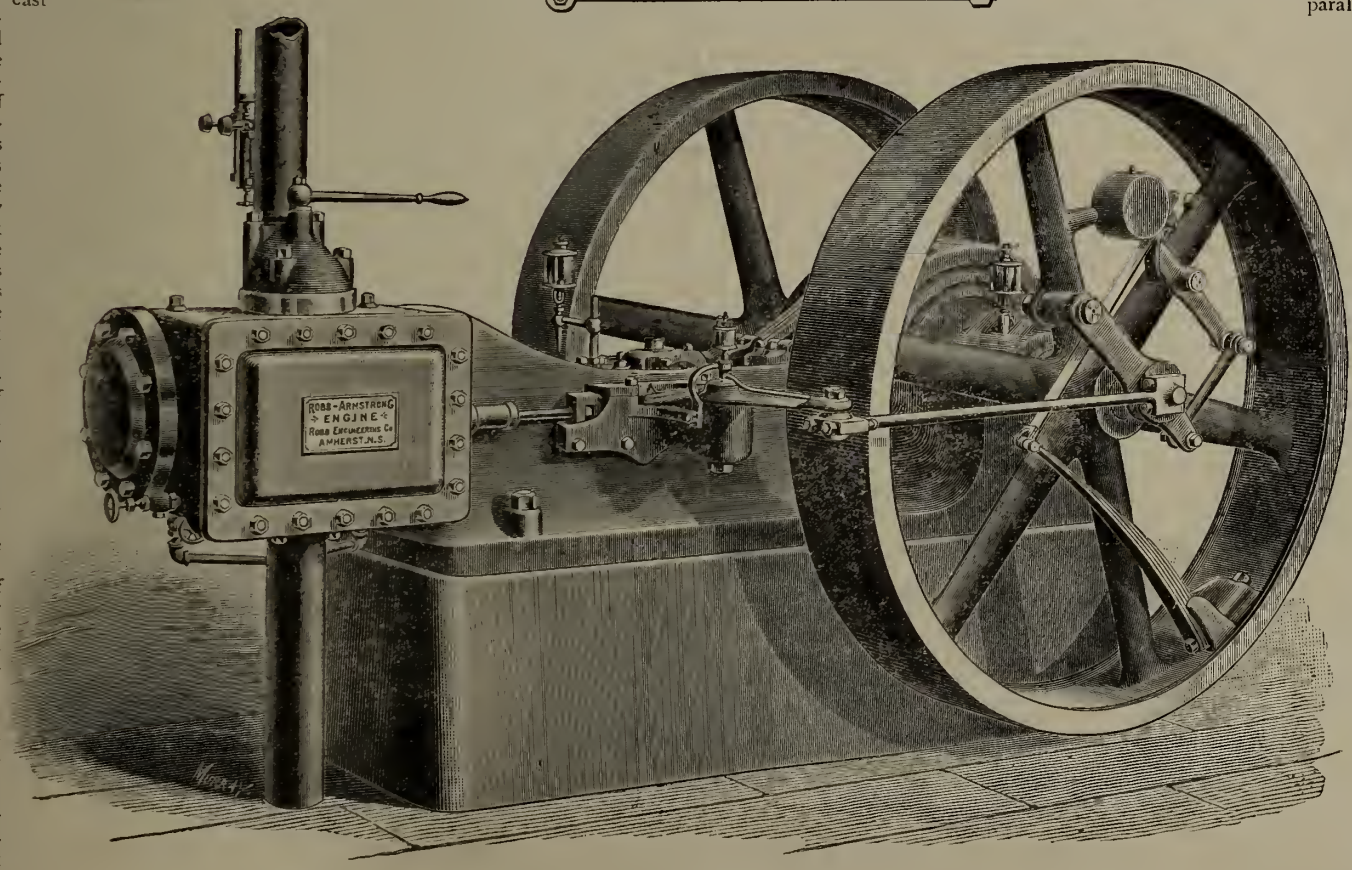


Fig. 3.

The crank is "built up of cast disks and forged steel pin and shafts, the peculiar arrangement of the crank permitting the fits of the shafts and pin in the disks to be very long, without separating the shaft bearings unduly, as is shown in the cross-section at the right of fig. 2; the counterweight is of equal moment with the reciprocating parts. The shaft bearings run in cast iron shells, babbitted; they are not provided with means of adjustment for wear. The bearings are finished by grinding operations of great delicacy, and are round and parallel within a limit of variation smaller than the average machinist will usually detect, even with the aid of the micrometer. The shafts are made to gauge, and the shells are interchangeable, as are the other parts of the engine; hence, a duplicate set of shells may be kept for emergencies. The crank is covered by a cast-iron case, shutting it completely in except at the slot through which the connecting rod works. The crank disks are without the usual finished flanges on the periphery, the crank case being designed to have a substantial and finished appearance, and free access is given to the crank-pin box, when the hinged crank case is raised. The crank-pin is oiled through two ½" holes, one extending from each side of the crank to the center of the crank pin, all oil wasting from the inner ends of the shaft bearings being instantly carried to the crank, while all oil wasting from the outer ends of shaft bearings is caught, and by a ring riding on the top of shafts, and dipping into the oil below, is returned again and again to the bearing, until it finds its way to the crank-pin and escapes to the crank pit, to be drawn off and filtered. In practice the crank-pin does not need oiling other than as stated, but a sight-feed oil cup is provided in addition to those oiling the shaft bearings, which will, if desired, feed oil direct to the crank-pin through one of the ½" holes before mentioned.



THE "ROBB-ARMSTRONG" ENGINE.

The fly-wheel governor is a modification of the "Straight Line," and, together with the valve, is used by arrangement with the Straight Line Engine Co.; the oiling devices mentioned will also be recognized as essentially "Straight Line." The eccentric rod, so called, although there is no eccentric, has ball and socket bearings at each end, the balls being case-hardened and ground, and the sockets or boxes of phosphor bronze. The rocker arm, by which the eccentric rod drives the valve, is horizontal, with a vertical axis; there is no twisting strain on either of its bearings, a straight line passing through all three of them. An index finger attached to this arm, as shown in plan view, Fig. 3, shows, by the graduations over which it passes, the movement of the valve, and thus is of assistance in valve setting.

A small sight-feed oil cup, directly over the centre of the rocker arm, supplies oil through a tube to the outer end of the arm. The eccentric rod is hollow, being, in fact, a piece of hydraulic pipe, and through it the oil passes to the eccentric pin, any oil finally escaping being caught and held in the flanged fly-wheel.

The centre bearing of the rocker arm works in a bath of oil so arranged that it is constantly flooded, and so that no oil can escape to the floor, any overflow draining to the crosshead guide, and finally to the crank pit.

The crosshead is a single steel casting, of the "Slipper" type, the bottom of the slipper being babbitted. The piston rod is secured by being gripped in two places, about two inches apart, one place being threaded and the other a parallel fit. The crosshead is split and is gripped on to the rod by bolts; this proves very good, in that it can be taken apart and put together again without getting out of line more than permissable in the highest grade of engine work—a point in which the usual methods of securing piston rods to crossheads (with the exception of the taper fit and key) are often faulty. The crosshead pin is of cast iron, as it is believed that, in connection with the large and long bearing, it is the best material for the place. The connecting rod is a steel forging, the crank end being of the "Marine" type, while the crosshead end is mortised for boxes, which are cast iron, lined with babbitt. The adjustment is by a wedge and adjusting screws.

The babbitt used in the engine is made from eight parts Banca tin and one part each of antimony and copper. The piston is a single casting with sprung rings; it is made extremely light, both to save the cylinder from wear and to make it the "breaking-down piece;" though amply strong for all legitimate loads it is expected to be

weaker than other parts, the idea being that it is the best thing to break, when experiments to determine the compressibility of water are being made with it. The exhaust passages are jacketed by air spaces from the cylinder, and from the live steam in the steam chest. The throttle is a modification of the "Coffin Valve" used by the Straight Line Engine Co., but is operated by a lever instead of a wheel, or ball handles.

The workmanship is intended to be equal to that of any other engine built. The firm also build cheaper automatics, but this engine was brought out to fill a demand for which they have previously been obliged to import the best and highest priced American engines. The engine was designed and its manufacture organized by Mr. E. J. Armstrong, who is now with the Ames Iron Works, Oswego, N.Y., which company will also build the engine in this country.

A New Ventilating Fan.

At a meeting of the Lancashire Branch of the National Association of Colliery Managers, recently held at Wigan, Mr. Wm. Hopton, of St. Helens, brought before the meeting a plan of his new drum-shaped air producing fan. He said that the idea of an improved fan had been revolving in his mind many years, but he never contemplated that he would bring one out himself. In the early part of last year he drew a plan of a fan, but after repeated alterations and improvements, he had a wooden model made. Still he found that there could be no further improvement. He accordingly had a small fan made by Messrs. Daglish and Co., St. Helens, 4 ft. 6 in. by 3 ft., which gave great satisfaction in the quantity of air produced when tested. His fan is the shape of a drum, having eight blades or scoops. The air entered the fan on either one or both sides of its diameter, and discharged air all around its circumference. He wished them to understand that the fan caused streams of air to flow through it similar to a locomotive engine on the railway when it obtained water from a long trough in the centre of the road. Doubtless they had seen on the railway in the centre of the road a long trough of water about 200 yards in length. Now, when the engine ran along the line at a great speed, the water in the trough was scooped up into the tank, and as the speed of the engine increased the water rushed into the tank with a much greater force. So, in like manner, the air was scooped up into and through the fan by means of those eight blades which he had previously mentioned, and passed out of the fan all round its circumference, and as the velocity of the fan increased, the eight streams of air became stronger and stronger, till quite a hurricane of air was produced. "I believe," said Mr. Hopton, "that my fan will produce a greater quantity of air than any other, and with less horse-power too; because the fan is not heavy or ponderous. Only the shafts, blades, and arms revolve. It is not necessary that the blades should be made heavy and thick; boiler plates similar to other fans 40 ft. and 45 ft. in diameter, ¼ in, thick plate, will be quite sufficient. Suppose a current of air is travelling at a velocity of 300 feet per minute through an aperture or open space of one foot square, 300 cubic feet of air per minute will pass through the aperture. Agan, suppose the air is stagnant, motionless, and we are able to pass the aperture through the stagnant air at a velocity of 300 feet per minute, by the law of nature 300 cubic feet of air should pass through the aperture. By this illustration you will better understand the quantity of air that will pass through one of my fans. Suppose, then, that one of the fans is 24 ft. in diameter, and 9 ft. wide, its circumference will be 753·984 ft. Further, if the fan makes 100 revolutions per minute, its circumference will pass over a space of 7539·84 ft.; there are eight scoops in the fan, each one having an aperture near its circumference for air to pass through of 4 ft. wide by 9 ft. long, and, as there are eight such apertures, the total area is 288 ft. Multiply then 7539·844 by 288, and this will give you a grand total of 2,171,473 cubic feet of air. Gentlemen, I shall not attempt to make you believe my fan will produce over two million cubic feet of air per minute, for it would be impossible for the scoops of the fan to get hold of the air so quickly in its natural and dense state. The air would be much expanded or rarefied in passing so quickly through the fan; I therefore divide the quantity of air by four, yet I have over half-a-million cubic feet of air produced by the fan. Had I means at my disposal I would fix one at some colliery, and would guarantee that over half-a-million cubic feet of air would pass through it, or I would charge nothing for the fan. The two streams of air which passed through the diameter on both sides of the small fan when tested was too strong to be measured by the anemometer. It drew in the overcoat of an official of the firm, he having passed too near it. There is little weight or pressure of the air on the blades or scoops of the fan as it revolves. The air can slide freely, with little or no friction, through each aperture; not a weight of over two tons of air carried along with the blades, as some fans do, when revolving, before the air can escape therefrom. A cylinder, 17 in. diameter, 18 in. stroke, and 55 lb. pressure of steam, would work the fan the number of revolutions required, and when fixed would last a lifetime. At the close of Mr. Hopton's paper, a hearty vote of thanks was accorded to him, and it was decided to accept the invitation to St. Helens on the 23rd inst., to visit the fan at work at Messrs. Daglish's establishment, and afterwards to hold a meeting in St. Helens to consider the merits of the fan as exhibited.

Explosions, Gob Fires and Coal Dust.

At Longton, on the 22nd ult., Mr. Joseph Taylor delivered the twelfth of a series of mining lectures in connection with the Staffordshire County Council.

The chairman (Mr. Joel Settle, of the Madeley Coal and Iron Co.), confined his opening remarks chiefly to gob fires. With these he had had a great deal to do, in the most fiery seams and district in the country, and his remarks were on this account of special interest and value. Whenever any indications of a gob fire manifested themselves they must be attended to, as he never knew a case in which a gob fire was arrested or extinguished of itself. His experience taught him that the best plan, as a rule, was to build off the place threatened with a gob fire on the return side, as this would cause the carbonic acid gas to back upon the fire and so help to smother it.

Mr. Taylor commenced his lecture by stating that he would confine himself mainly to explosions and coal dust. He would comprehend his treatment under the following heads: (1.) Definition and condition of an explosion; (2) phenomena attending explosions; (3) afterdamp and other effects of explosions; (4) how explosions are caused; and (5) how they may be prevented. This would bring in the consideration of both gob fires and coal dust, and enable him to lay before them many important results of recent scientific investigations.

An explosion in a general sense, observed the lecturer, might be defined as rapid oxidation; but this was not sufficiently specific for their present purpose. As miners they had to deal chiefly with explosions of firedamp, but there were sometimes boiler explosions; and, as he should show, explosions of coal dust even when there was no firedamp present to begin with. In dealing with the conditions of an explosion as commonly understood, Mr. Taylor explained that there must be present a certain amount of marsh gas, methyl hydride, or firedamp, CH_4; and this must be mixed with a certain amount of atmospheric air; the mixture giving the greatest heat and force, as well as the loudest report possible, being one part firedamp with nine and a-half parts of atmospheric air. The afterdamp produced by an explosion under these conditions was not composed exclusively of chokedamp, but of seventy-one parts nitrogen, twenty parts aqueous vapour, and nine parts only of chokedamp, or carbon dioxide, in every hundred. The relative proportion of these substances, however, was soon changed, owing to the condensation of the aqueous vapour on the comparatively cold surface of the roads. These points were illustrated by beautiful experiments, as also was the necessity for a definite mixture in order to give the maximum explosive force and temperature.

The temperature produced by an explosion occurrring under the conditions supposed might be imagined, from the fact that 1 lb. of CH_4 burning to CO_2 and H_2O yields about 23,550 units of heat; which might be converted into units of work by multiplying by 772. In the experiment showing this rapid and considerable rise of temperature, the glass instrument used was smashed almost immediately after being lighted.

This rise of temperature causes a sudden expansion of the air and gases present; and the expansion is so great that 1 cubic foot of mixed firedamp and air on being exploded, becomes at the moment of explosion no less than 8 cubic feet. The lecturer enlarged on these facts as explaining the origin of the explosive wave, as well as the dire effects of explosion.

The force developed by an explosion under conditions of the maximum explosive mixture equals 13·8 atmospheres, or 30,000 lbs. per square foot, and exceeds that of the most disastrous hurricane. If, in case of a hurricane, the air travels at the rate, say, of 100 miles an hour, the pressure per square foot upon bodies with which it comes in contact is only about 50 lbs. per square foot; and though this is sufficient to tear up trees and blow down bridges and almost every kind of masonry we in England construct, it is as nothing when compared with the 30,000 lbs. per square foot obtained in a colliery explosion. Such facts as these would enable them to understand how it is that frequently explosions tear down the roof, displace the timber, break up strong iron plates, wheels and axles.

Those who, like himself, had personally witnessed explosions, knew that they were generally attended by several distinct shocks; and these, he considered, had not so far been sufficiently understood and explained by mining authorities. The first shock produced the most disastrous effects, and was felt all along the line of the explosive wave, and often to great distances from the seat of explosion. It was due principally to the force developed by the expansion of air and gases owing to the great increase of temperature. The second shock, which was sometimes almost equally disastrous, was generally due to the formation of a vacuum, partly in consequence of the rush forward, but chiefly as the result of condensation of volume. A mixture of one cubic foot of firedamp with nine cubic feet of air, making altogether ten cubic feet, would, after explosion, occupy only nine cubic feet, thus forming one foot of a vacuum. In case of mine explosions the vacuum thus produced was considerable, and the rush of air to fill this gap up immediately after the first shock, under the enormous weight of the atmosphere, was the chief cause and explanation of the second shock. A third shock was also frequently noticed, and this was shown to be due chiefly to the rebound of the air and gases owing to their great elasticity. Sometimes also, explosions were of a compound and very complex character, owing to the escape of occluded gas from the coal sides into the vacuum, and also to the influence of the heat on the coal dust, producing firedamp sufficient to cause a repetition of the explosion, and sometimes more than one.

In dealing with the causes and prevention of explosions, it was impossible to avoid saying something respecting coal dust. In giving his evidence before the Royal Commission on Coal Dust, Mr. W. N. Atkinson, Her Majesty's inspectnr of mines, had regarded coal dust proper as that which was sufficiently fine to pass through the meshes of a standard wirc gauze; and this Mr. Taylor considered the best definition of coal dust yet given. Such dust was not explosive of itself, in the same sense as gunpowder, as was proved experimentally; but if very dry and suspended in the air so as to be in a position to admit of the carbon being rapidly oxidised, it doubtless did become explosive. The function of coal dust in relation to the cause of explosions was a somewhat vexed question, and the lecturer was anxious not to be dogmatic; but he, personally, was decidedly of opinion that an explosion might take place in conjunction with a blown-out shot in case coal dust was suspended in the air in sufficient quantity, even if there were no firedamp present whatever to begin with. The explanation was easy enough. Coal dust, as was illustrated by diagrams showing its appearance under the microscope before and after explosion, was porous and contained a large amount of occluded gas. This was driven off by a flame from a blown-out shot. The dust was distilled, even as coal is in the process of gas manufacture. The firedamp thus produced at once explodes, and causing still further distillation of gas from the coal dust itself, may give rise to a series of explosions almost simultaneously, and propagate the disaster as far as the coal dust extends and is sufficiently dry. This, said Mr. Taylor, was one of the most recent and important results of scientific investigation. It might now be considered as almost beyond controversy, as an established fact; and hence he felt justified in introducing the question in the present course of technical lectures. The possibility of exploding coal dust was practically demonstrated by an experiment.

The subject of gob fires having been dealt with so ably by the chairman, the lecturer said he would confine his remarks to the much-controverted question as to the cause of gob fires. It had long been held that these spontaneous ignitions were due to the oxidation of iron pyrites present in the coal, but this theory always had to face very formidable difficulties. It was true that iron pyrites in sufficient quantity might be made to burst out into flame, but it very rarely happened that there was enough of this compound present in coal to cause spontaneous combustion, since those varieties most liable to and noted for self-ignition only contained about 0.8 per cent. As against the common theory, it was also a remarkable fact that gob fires frequently broke out in seams where scarcely any pyrites was present, and in some seams noted for its presence no gob fires had occurred. These facts and a number of others adverted to by the lecturer, especially the peculiar property of carbon for condensing and absorbing gases on its surface, led the theory in question long since to be suspected, and now we are in a position to announce that without question gob fires really result not from the oxidation of iron pyrites, but from the heat developed during the oxidation of the coal itself. Temperature, dryness, capacity for absorbing moisture, and fineness of the particles, were also shown to be very important factors. When the gob began to give off smoke and "stink," and the temperature became sensible, especially when the thermometer indicated 90 degs., it was time to make a move, and then the air supply must by some means at once be shut off so as to prevent further oxidation. Whether the stopping should be built on the intake or return side of where the fire was threatened was a matter which could ouly be determined by special circumstances, and no universal law could be laid down. No theory would fit all possible occasions, and much depended upon intelligence, practical experience and careful technical education.

The Prevention of Winding Accidents. — A new apparatus for the prevention of winding and over-winding accidents at collieries and blast furnaces, is described by Mr. W. Grimmit, in the *Transactions* of the Federated Institution of Mining Engineers, vol. ii., page 243. Two cylinders partly filled with liquid are connected by a pipe at their lower ends. In this pipe is a valve for regulating the speed of flow from one cylinder to the other, and the pipe is also passed through five or seven small cylinders in which loose plugs can rise and fall. When these plugs come opposite the tube, they obstruct the passage of liquid from one main cylinder to the other. Plungers in these two main cylinders are connected by a rope over a drum, driven to correspond with the main winding drum, so that their position indicates the whereabouts of the cages in the shaft. If from any cause the speed becomes too great, the liquid cannot, owing to the regulating valve in the pipe connecting the cylinder, maintain a constant level. Accordingly a float in an indicating cylinder connected to the main cylinder, falls, and, through tripping mechanism, closes the steam valve and puts on the brake—the latter operation being performed gradually owing to the interposition of a pneumatic cylinder. The ordinary speed of winding is controlled by the regulating valve, but the speed may also be controlled at or from any suitable point by means of the plugs above referred to. One or two may be connected to the indicating gear, so as to obstruct the passage of fluid, and thereby stop or slow down the engine at any desired point. The other plugs can be used for stopping the cages at intermediate insets in the shafts, and one plug may be connected to a wire in the shaft used for signalling purposes.

LEGAL.

WILLS vs. STEWART.

Side Lights on the General Phosphate Corporation.—Broker Sando's Fat Commissions.—Interesting Facts of the Defunct Phosphate Boom.—Boodle Galore.

The suit of J. Lainson Wills, F.C.S., late manager to the General Phosphate Corporation, against George Stewart, vendor of the High Falls phosphate properties to the General Phosphate Corporation, and until recently its mining contractor, claiming commissions outstanding on the sale of the property, comes off at Aylmer on 17th instant. Interesting revelations of the inception, organization, management, and subsequent failure of the Corporation are promised. In the meantime, knowing the interest that is taken in the event, we have taken special pains to get at some of the facts, which we present herewith. J. Lainson Wills came to Canada in June, 1888, under a two years' engagement as manager with the Canadian Phosphate Company, Limited, of London, operating certain phosphate mines on the Lievres River. This engagement terminated after the completion of the first year, and from June, 1889, he resided in Buckingham, where he carried on practice as a consulting mining engineer. Among local properties reported upon by Wills about this period may be mentioned :

(1) The Glasgow-Canadian Phosphate Company's mines in the Townships of Portland and Derry.

(2) The Squaw Hill and Aetna mines, now operated by the Anglo-Continental Guano Works Co., of London, England.

(3) The Little Rapids mine and other properties owned by W. A. Allan.

(4) The Central Lake mines, owned by S. P. Franchôt and others.

(5) The Blackburn mine in Templeton, now owned by the East Templeton District Phosphate Syndicate.

(6) The McMillan mine, owned by the Dominion Phosphate Company, of London, England.

(7) The North Star mine, owned by the Dominion Phosphate and Mining Company, of New York.

(8) The Murphy mine, Templeton, property of Sir J. J. C. Abbott and Hon. C. C. Colby, since acquired by the Corporation.

(9) All the Stewart phosphate lots in the Township of Bowman (amongst which are the High Falls group, sold to the Corporation), the whole containing 1450 acres.

The last named is the object of the present reclamation. The properties were reported on by Wills on 30th July, 1889, and the original report with maps, etc., handed to Stewart, for which Wills received the sum of one hundred dollars.

In November, 1889, Stewart, in company with E. B. Haycock, of Ottawa, sailed for London with the object of finding a buyer for the phosphate properties above mentioned. About this time the "boom" took place, and several important sales of Canadian phosphate mines were made, notably the Blackburn, the Squaw Hill and Aetna, the McMillan, and others. With the object of assisting Stewart in his negotiations, Wills sailed for England in January, 1890. He avers that Stewart had personal interviews with him daily, and that he (Stewart) was depending on his information and advice to obtain purchasers for his properties. Wills, however, had not so far received a cent from Stewart outside of the fee of $100 for his report.

STEWART'S AGREEMENT WITH WILLS.

Wills contends that the arrangement for recompense was based on Stewart's letter to him, dated London, 20th February, 1890, as follows :

"In consideration of your services rendered, and now rendering, in connection with the sale of the following phosphate lands, in which I am interested, that is to say :

The Bowman group and Poupore, 400 acres.
High Falls group, 1,450 acres.
Ray and Cowan group, 400 acres.
McKenzie group, 200 acres.
Chapleau group, 700 acres.
Allan group, 1,000 acres.
J. W. McLaren group, 216 acres.
McCallum group, 400 acres.

On a sale being effected of the part or whole foregoing properties through the aid of your aforesaid professional services, I agree to pay 2½% of the cash sale obtained.

Very truly yours,
(Signed), GEO. STEWART."

The Stewart properties were acquired by the General Phosphate Corporation, Limited, of London, for a consideration of forty thousand pounds sterling, Wills being present with Stewart in the offices of the Corporation at the time of the drawing up of an agreement dated at London, 30th September, 1891, by which the sale was determined. It was thus taken for granted by Wills that the commission of 2½% on the £40,000, namely, £1,000, (or $4,866.69) was justly earned, it being only a question of Stewart having the funds in order to obtain a settlement. Wills avers that it was only after presenting his statement of current accounts to Stewart in September, 1891, that Stewart's objection was made to the payment of this commission.

STEWART'S DEED OF SALE TO THE CORPORATION.

An agreement made the third day of September, one thousand eight hundred and ninety, between George Stewart, of 128 Lyon Street, Ottawa, in the Dominion of Canada (hereinafter called the Vendor) of the one part, and the General Phosphate Corporation, limited (hereinafter called the Corporation) of the other part. Whereas, the Vendor is entitled for an absolute estate in possession, free from encumbrances, to the several phosphate properties and rights hereinafter described, and he has procured from the persons whose names are set forth in the second schedule hereto, the reports and analysis in the said schedule mentioned with regard to the character of the said properties and the nature and quality of the phosphate produced therefrom. And whereas the Vendor has furnished the Corporation with a statement in writing, which he has represented to be an accurate epitome of the said reports and analysis, and to be an exact description of the said properties; and the said statement, as also the said reports and analysis, have, for the purpose of identification, been signed by the Vendor and Lydstone Joseph Langmead on behalf of the Corporation. And whereas the Vendor is desirous of selling the said properties to the Corporation, and the Corporation is willing to purchase the same upon the terms hereinafter mentioned, but subject to the power of rescission hereinafter contained. Now it is hereby agreed as follows :—

The Vendor shall sell and the Corporation shall purchase, all those pieces or plots of freehold land situated on the River Lievre, twenty-one miles from Buckingham, in the County of Ottawa, in the Province of Quebec, and Dominion of Canada, amounting in the aggregate to one thousand four hundred and fifty acres, and known as the High Falls group of phosphate properties, and (the several lots of which are more particularly described in the first schedule hereto) together with the mines and mining and other rights, and the plant, machinery, stock and other property which are now on the said properties or belong to the Vendor in connection therewith, all of which land and premises are hereinafter called the scheduled premises.

2. The Vendor shall, immediately on the execution of these presents, hand over to the Corporation the original reports and analysis referred to in the second schedule hereto, and he shall, if so required by the Corporation, execute a statutory declaration that the said reports and analysis were in fact made by the respective persons by whom they purport to have been made.

3. The Corporation shall, with all reasonable despatch after delivery of the said reports and analysis, direct George Attwood, of Lombard Street, in the city of London, or some other competent person (to be approved by the Vendor) to proceed to the scheduled premises and personally test the accuracy of the said reports and analysis, and report to the Corporation upon the extent, nature, prospects, convenience and general desirability of the scheduled premises, and unless the report of such person shall confirm in every essential respect the said statement of the Vendor, the Corporation shall be at liberty, by notice in writing, served upon the Vendor on or before the thirty-first day of December, one thousand eight hundred and ninety, to rescind this agreement.

4. The Vendor shall warrant the accuracy of the statements contained in the said statement in writing, furnished by him to the Corporation as above recited, and the Corporation, if it does not avail itself of the right of rescission conferred by the last preceding clause, shall be entitled to recover from the Vendor, and he shall be liable to make compensation to the Corporation for, any loss arising from any misstatement of fact in the said statement.

5. The Vendor shall make out, to the satisfaction of the Corporation, a good title to the scheduled premises for an absolute estate in possession, according to the laws in force in the said Province of Quebec, free from all encumbrances.

THE PURCHASE CONSIDERATION.

6. The consideration for the said sale shall be the sum of forty thousand pounds, whereof ten thousand pounds part thereof shall be paid in cash on notification being made to the corporation, as hereinafter provided, that the transfer of the scheduled premises has been completed and the residue of thirty thousand pounds shall, but subject to the proviso for reduction hereinafter contained, with interest in the meantime at the rate of six per cent. per annum from the date of completion, be paid on the thirty-first day of October, one thousand eight hundred and ninety-five. The payments of the said sum of thirty thousand pounds, reducible as hereinafter mentioned, shall be secured by the covenant or covenants of the Corporation to pay the said sum, or the reduced sum, on the said thirty-first day of October, one thousand eight hundred and ninety-five, and the Corporation will also execute, in favor of the Vendor, an instrument of charge over the scheduled premises, for further securing the said thirty thousand pounds, or reduced amount, which instrument shall, however, contain provisions reserving to the Corporation the fullest power of carrying on business upon the scheduled premises, without notice to, or the consent of, the vendor, and reserving, also without such notice or consent, power to lease the property comprised in the said charge, as it may deem expedient, provided that the rent or other benefit reserved by, or payable under, any such lease, shall be subject to the said charge, and the said instrument shall further contain a provision that the said debt and the security therefor shall not, nor shall either of them, as to ten thousand pounds, part thereof, be assignable by the vendor for any cause whatever, without the consent of the Corporation being first obtained for that purpose.

7. The Corporation shall appoint some person in Canada to be its attorney or agent, with full powers in relation to the completion of the sale of the scheduled premises, and shall notify such appointment to the vendor not less than twenty-one days before the time hereinafter fixed for completion.

8. The sale shall be completed in Ottawa, in the said Dominion of Canada, on or before the thirty-first day of October, one thousand eight hundred and ninety, when the vendor shall duly transfer the scheduled premises to the Corporation or its nominees. The Corporation shall, at the time of such transfer, pay to the vendor, or as he shall direct, the said sum of ten thousand pounds, and will, within thirty days thereafter, execute, in favor of the vendor, the covenant and deed of charge referred to in clause 6 hereof.

£15,000 FOR PLANT AND A GUARANTEED OUTPUT.

9. Possession of the scheduled premises shall be given to the Corporation at the time hereby fixed for completion and the vendor shall thereupon proceed to provide and set up on the scheduled premises machinery, plant and appliances suitable for working and getting the phosphate of lime on the said premises. The said works shall be executed by the Vendor, under the direction and to the satisfaction of J. Lainson Wills, M.E., of Buckingham, Ottawa, aforesaid, or other the engineer for the time being of the Corporation, to be approved by the Vendor, and shall be completed within six months from the date of possession being taken by the Corporation. The Vendor guarantees that the sum of fifteen thousand pounds shall be sufficient to complete the said works and leave a sum sufficient for working capital to be employed in carrying on the scheduled premises and the Corporation hereby agree to expend and employ that sum or such less sum as may be required for these purposes and will immediately after completion of the purchase pay to the Vendor an instalment of two thousand pounds for the purchase of the necessary plant machinery, or such other sum as the said engineer may certify to be required for the purpose, and upon production of the certificate of the said engineer that work of that value has been executed to his satisfaction by the Vendor, such further portion or portions of the said sum of fifteen thousand pounds as may be applicable and necessary from time to time to be certified by the said engineer to the completion of the said works. The Vendor will, for a period of twelve calendar months at least after a commencement shall be made to work the phosphate on the scheduled premises, devote his whole time and attention to the working and development

AT A SALARY OF ONE THOUSAND POUNDS

for that period, and will, under the direction aforesaid, carry on the operations thereat; and the Vendor hereby guarantees that during the said first twelve calendar months after the fixing of the said plant and machinery and the commencement of operations for working the phosphate on the scheduled premises with the use of plant and machinery erected by the Vendor as aforesaid and the residue of the said sum of fifteen thousand pounds being employed as working capital, an output of not less than ten thousand tons of phosphate ore, containing not less than seventy-five per cent. of phosphate upon an average, so that no ore containing less than seventy per cent. is shipped, will in the ordinary course of working be yielded and will be put free on the wharf at Montreal at a total cost to the Corporation for mining and transport of not more than nine dollars per ton, and the vendor hereby agrees that if the said guarantee is not performed, the Corporation will, out of the thirty thousand pounds secured to the Vendor by the instrument mentioned in clause 6 hereof, be entitled to retain absolutely for its own use the sum of ten thousand pounds, and the said instrument of charge shall contain a proviso restricting the indebtedness of the Corporation thereunder and reducing the charge on the said scheduled premises by a sum of ten thousand pounds with all interest thereon in the event of the Vendor failing to implement and perform the guarantee hereinbefore expressed and contained.

10. The Corporation shall provide the Vendor with the necessary funds to pay mining and transport at the rate of not exceeding nine dollars per ton, but the Corporation are under no obligation to find any further moneys until the said fifteen thousand pounds shall have been exhausted, and then only such sums as shall represent nine dollars per ton in respect of ore delivered at the wharf at Montreal and certified by the engineer.

11. The Vendor and the Corporation shall pay their respective costs of, and incidental to the preparation and execution of this Agreement and of the transfer of the scheduled premises to the Corporation, and if the result of the inspection and report to be made pursuant to clause 3 hereof, shall be deemed unsatisfactory, by the Corporation, or if the Vendor shall fail to show a good title as aforesaid to the scheduled premises, the Vendors shall pay all costs, charges and expenses incurred by the Corporation in relation to such inspection and report, but so that such last mentioned costs, charges and expenses shall not exceed the sum of seventy-five pounds.

12. For the purpose of this Agreement any notice may be given to the Vendor by leaving the same for him at the Bank of Ottawa, in the city of Ottawa, in the Dominion of Canada, or (at the option of the Corporation), by leaving the same for him at the office of Messrs. Harper & Battcock, Solicitors, 23 Rood Lane, in the city of London, and any notice so left shall be deemed to have

reached the Vendor within fourteen days after its being so left.

13. If, and so often as any difference shall arise between the Vendor and the Corporation as to the meaning or construction, or the effect, incidence or consequence of this Agreement or any part thereof, or any article or clause herein contained, or otherwise relating to the premises; every such difference shall be referred to the arbitration of two Arbitrators, one to be appointed by each party, with liberty to them to appoint an umpire or third arbitrator, and this submission shall be subject to the provisions of the Arbitration Act, 1889, or any subsisting statutory modification thereof.

In witness whereof the said George Stewart has set his hand, and Sir Jacob Wilson, the Hon. Cecil Parker and H. Mallaby Deeley have set their hands on behalf of the General Phosphate Corporation, Limited, the day and year first above written.

THE FIRST SCHEDULE ABOVE REFERRED TO.

Description of the lots of the property agreed to be sold:—

Lot 6 in the 10th Range of the Township of Portland West.

Lots 1, 2, 3, 4, 5 and 6 in the 4th Range, Bowman.
Lots 17, 18, 32 and 33 " 3rd " "
Lots 31 and 32 " 2nd " "
—1450 acres.

THE SECOND SCHEDULE ABOVE REFERRED TO.

Report dated 30th July, 1889, made by J. Lainson Wills, F.C.S. and M.M.S., of Buckingham, late manager of the Canadian Phosphate Company, Limited

Report dated 12th June, 1889, made by Robert Bell, B.A., M.D., LL.D., F.C.S. and F.R.S.C., Royal Commissioner on the Mineral Resources of Ontario.

Analysis dated the 2nd January, 1890, by George Patterson, F.I.S., F.C.S., of Idol Lane, in the city of London.

Witness to the signature of George Stewart, the said George Stewart.

J. H. Davidson,
40 and 42 Queen Victoria street, London,
Solicitor.

For and on behalf of the General Phosphate Corporation, Limited—

Jacob Wilson,
Cecil T. Parker,
H. Mallaby Deely } Directors.

Lydstone J. Langmead,
Secretary.

We have examined the above with the original agreement, and certify it to be a true copy thereof.

Dated, this 10th day of September, 1890.

Walter Harris,
J. Henry German,
Clerks to Messrs. Davidson & Morriss,
20 and 42 Queen Victoria St. London, E.C.,
Solicitors.

STEWART'S AND SANDO'S SHARE OF THE SPOILS.

In an interview with the plaintiff, we learned the following particulars of this now historic transaction. Stewart sold to the Corporation for £40,000 sterling at the time of the transfer of his properties. A mortgage to the amount of £20,000 sterling was negotiated by Mr. Knud Sando, a London Broker, now posing as one of its directors, which realized, according to a statement made by Sando, £18,600. Sando retained £11,000 as his commission. Stewart therefore asserts that he has so far received only £17,600 for his phosphate properties sold to the Corporation. By the agreement made between Stewart and the General Phosphate Corporation on the 9th September, 1890, Stewart was to leave £10,000 in the hands of the Corporation as a pledge and guarantee for the fulfilment of his contract. Wills also states that in a personal interview with Stewart at Buckingham on 28th September, 1891, the latter showed him a typewritten statement and cash balance, which he stated was rendered by Sando for his negotiation of the £20,000. The figures quoted, he states, are taken from this account.

THE OTHER SIDE OF THE CASE.

Mr. Stewart, on the other hand, states that after the signing and delivering of the letter in Wills' declaration, the Plaintiff wholly failed to sell the property, and that afterwards, about the end of August, 1890, Plaintiff entered into the employ, and became the agent and servant of "The General Phosphate Corporation, Limited," that thereupon the engagement and proposed engagement between Plaintiff and Defendant referred to in said letter ceased, that Plaintiff did not thereafter take part in the sale of the property referred to in said letter as the agent, servant, or broker of Defendant, and that Plaintiff never thereafter assisted in the sale of said property, and Plaintiff never assisted Defendant in disposing of said property, and that Defendant never sold said property through the aid of any professional or other services rendered Defendant by Plaintiff.

That after Defendant had entered into the employ of the said General Phosphate Corporation, Wills was sent to Canada by said Corporation to report on the said property referred to in said letter, along with other property, and that any report or statement Willls made in connection with said property was made in his capacity of agent, servant and engineer of said Corporation, and was not made in virtue of the arrangement referred to in said letter and in Wills' declaration, and that Stewart never was, and is not bound or obliged to pay any commission therefor, or any consideration whatsoever therefor.

That on or about the 5th day of November, 1890, Stewart sold the property referred to, along with other mineral property, to "The General Phosphate Corporation, Limited," aforesaid, and that if Wills' services or his report in any way contributed to the sale thereof, which is not admitted, but especially denied, such services were rendered and such report was made to said Corporation, by the engineer and servant of such Corporation, and not by reason of said letter, or by reason of any engagement with Defendant.

That the sums of money paid by Stewart to Wills and referred to in his declaration were paid to assist Wills and because he had been of some service to to Defendant in various ways, but the same were not paid because Defendant was legally bound and obliged to pay the same, and in any case the amount was more than sufficient to pay Wills for any services rendered.

Stewart further declares that he only derived from the sale of the property to the Corporation, after all commissions had been deducted and paid, about £16,000. Of this he received £10,000 in cash, and that his securities, which represented the balance, after commissions for the same were deducted, only brought him £6,000. Stewart states that the others who owned an interest in the High Falls property were Newell Bate, of Ottawa, and Thos. Bate, of St. Catherines. Other parties are also claiming commissions from Stewart for the sale of the property, or for the negotiation of his securities. Among them Knud Sando, Broker, London, England; Hawkins & Co., London, England; Kimberly & Co., London, and J. A. McIntosh, of Toronto. Stewart states that he has already paid Wills $2,141.30 for the services sued for, and that this amount is more than sufficient to cover his claim.

EXTRACTS FROM WILLS' DEPOSITION.

Q. Didn't Mr. Sando have something to do with the sale? A. Probably he completed it.

Q. You know Mr. Sando? A. Yes; he is a broker.

Q. Did you know that Mr. Stewart had dealings with him in connection with the sale of the property referred to in Exhibit No. 1? A. No.

Q. You did not see them together in London? A. He had dealings through a broker—through an intermediary; I do not know that he had dealings with Mr. Sando. He would have dealings indirectly with him through brokers with whom I was in contact. There comes the pull.

Q. Didn't you see Mr. Sando working for Mr. Stewart at this time? A. No. Mr. Sando asked me in the most direct manner for my appreciation of Mr. Stewart's properties.

Q. When did he ask you? A. Immediately on my arrival in London.

Q. In what month? A. In January, 1890.

Q. He was interesting himself, then, at that time, about the sale of these properties? A. No.

Q. Do you swear he was not? A. It was more as a purchaser.

Q. He was interesting himself about the sale, was he not? A. As a purchaser.

Q. If he was a broker, he would not likely purchase them himself? A. He would not sell them unless he had a bond on them himself.

Q. Do you know he had a bond for the sale of this property from Mr. Stewart at the figure of £29,000. A. At the time he could not have.

Q. Do you know that he afterwards had? A. I do not know that he had.

Q. Do you swear positively that he had not? A. I can swear I do not know when Mr. Sando obtained a bond on Mr. Stewart's property.

Q. Do you swear that you do not know anything of such a bond? A. I know that the sale was afterwards completed.

Q. By whom? A. By the Corporation.

Q. Through whom? A. That I do not know.

Q. Don't you know that Mr. Sando conducted negotiations that led up to the sale to the Corporation in your absence? A. I do know that.

Q. When? A. Since my return. It was during my absence from London that was completed.

Q. Mr. Sando then had charge of the negotiations to a certain extent which led up to the signing of the document of which it is claimed Exhibit "A 1" is a copy. A. I surmise so.

Q. You were not in London at the time the basis of this arrangement was arrived at, Exhibit "A 1?" A. Yes.

Q. I thought you had left London? A. I have told you already that I returned in July. This was drafted one or two days before it was signed.

Q. You knew that Mr. Sando at the time was looking after the interests of Mr. Stewart, and trying to sell the property for him? A. That I do not know.

Q. You do not? A. No. I recognized Mr. Sando at that time. I am talking of that time. What month are you talking of?

Q. I am speaking of September, 1890. You recognized Mr. Sando at that time? A. In what way?

Q. I am asking you in what way. You said you recognized him didn't you? A. Doing what?

Q. Bringing about these sales. A. Mr. Sando was taking a prominent part as a promoter in September, 1890.

Q. He was promoting for the purpose of getting the Corporation that was being formed, or that had been formed, and that he was instrumental in forming to purchase this property? A. Yes. He would have obtained a bond, and was endeavouring to sell to the General Phosphate Corporation through brokers.

Q. Don't you know that the figure was mentioned in that bond of £29,000? A. No; I did not know it at that time.

Q. You have known it since? A. Yes.

Q. And you have seen sufficient and know sufficient to enable you to say that you have no doubt that Mr. Stewart had then given a bond of sale on his property for £29,000? A. I do not know that.

Q. Did you not say that just now? A. I made a mistake if I said it.

Q. Who told you of this bond that you have spoken of? A. I should know that Mr. Sando could not well offer the property at that time without having some hold on it. At least I should surmise.

* * * * * *

Q. When did you first hear of the £29,000 being the price mentioned in the bond? A. It would be after the time of the misunderstanding between Mr. Stewart and myself with regard to the commission I am claiming When he showed me a document purporting to be an account current between Mr. Sando and himself which exhibited the same amount that he stated to-day. That is the first time I knew of the price of any commission that Mr. Sando was getting.

Q. When was that? A. In Buckingham, after the sending of my account in to him; some time away into the summer. I could not say exactly.

Q. That was about what year? A. Last year; 1891. the summer of 1891.

Q. You went home to England lately, did you not? A. Yes.

Q. Did you learn there that Mr. Sando had received the commission from Mr. Stewart. A. Yes; generally I think I did.

Q. Did you not learn it there? No; I did not learn it there. I learned it first from Mr. Stewart in 1891.

Q. When you got back to England you realized that what Mr. Stewart had told you was true? A. Mr. Sando told me, I think. I think that is the only information I got on the other side.

Q. Are you in the employ of the General Phosphate Company at present? A. I am not.

Q. Are you aware that the 10,000 tons of phosphate that were to be delivered by Mr. Stewart in conformity with that contract under a forfeiture of £10,000 has not been delivered? A. I am aware it has not been delivered.

Q. You are aware that Mr. Stewart was in a position that it was impossible to deliver it from these mines within the time specified in the contract? A. No.

Q. Were you not engineer for the General Phosphate Corporation? A. Yes.

Q. You know that it was not done? A. I know that it was not done.

Q. And you know that it was not through the fault of Mr. Stewart that it was not done? A. Yes, it was through his fault.

Q. You swear that? A. Yes; it depended on Mr. Stewart entirely.

Q. You did not assume any responsibility at all? A. No; not as engineer of the Company.

Q. All the works were carried on under your management? A. No; they were not.

Q. What were you there for? A. To control.

Q. To control Mr. Stewart? A. To control the putting up of machinery and Mr. Stewart's accounts.

Q. Do you think that Mr. Stewart would wilfully incur that forfeiture of £10,000? A. I do not know. I cannot account for Mr. Stewart's actions.

Q. He is a strange man in your estimation? A. I do not know. I do not say so.

Q. I suppose you thought he was a strange man when he signed this letter, Exhibit No. 1 A? A. I think he is a strange man when he does not fulfil the terms of it.

Q. You did not think he was a strange man when he signed it? A. I had not much experience of him then.

Q. You had a quarrel with Mr. Stewart lately? A. No, nothing more than difference of settlement of affairs, which had been the basis of Mr. Stewart's proposed sale.

Q. The General Phosphate Corporation consulted you? A. Yes.

Q. Did they pay you for it? A. not then.

Q. Did they pay you afterwards for those consultations? A. Yes, they paid me a fee of £100 or guineas, I forget which now, to control George Attwood's report.

Q. What was George Attwood's report? A. On other properties which they were acquiring together with Mr. Stewart's.

Q. Did George Attwood's report refer in any way to the properties referred to in exhibit No. 1? A. No.

Q. Did you ever make any report to the General Phosphate Corporation in connection with this property? A. Not to the General Phosphate Co.

Q. You swear that positively? A. To George Stewart.

Q. You swear that you did not make any report and they have got no report that you made to them in connection with the properties referred to in exhibit No. 1? A. I have to understand this question before I can answer it.

Q. You swear that you did not make any report and they have got no report that you made to them in connection with the properties referred to in exhibit No. 1? A.

I have made no report to the General Phosphate Corporation as far as I can recognize any of these properties. It is very probable that they may be in possession of several reports which I have made for other people. They all gravitated to the General Phosphate Corporation.

Do you swear positively that you did not make a report direct to the General Phosphate Corporation of any of the properties referred to in exhibit No. 1, previous to the sale thereof.

Objected to as illegal and irrevelant.

Objection reserved.

A. I have not reported on any of these properties to the best of my knowledge that I recognize here to the General Phosphate Corporation.

Q. Did you report to the promoters of the General Phosphate Corporation before its actual incorporation in connection with any of the properties referred to in exhibit No. 1? A. Who are the promoters?

Q. I am asking you, you know more about them than I do? A. I do not know.

Q. Have you got any idea who would be the parties interested in the General Phosphate Corporation, and who were the parties interested in it in September and November, 1890. A. Yes.

Q. Who were they? A. The directors.

Q. Who were they? A. Sir George Baden Powell, Mallaby Deely, Lord Stalbridge, Sir Jacob Wilson and Cecil Parker.

Q. Did you make a report to any of these parties that you have mentioned in connection with the properties that are referred to in exhibit No. 1? A. No, positively not.

Q. Did you not see Mr. Sando engaging himself on behalf of Mr. Stewart from the time you returned to London in July, 1890, until the signing of exhibit "A 1" or the original agreement of which it is claimed that exhibit "A 1" is a copy? A. Yes, I saw him.

Q. You saw him doing what? A. I saw him. I met him and heard from him that the business was going on—proceeding.

Q. You knew then that he was taking up the matter for Mr. Stewart? A. Not more than he was continuing to consult me also as well as Mr. Stewart.

Q. It is not customary for a man in Mr. Sando's position to do such things I suppose after he had been engaged by Mr. Stewart to do so? Do brokers work for nothing in London? A. I cannot say.

* * * * * * * * *

Q. Do you know if they paid cash to Colby, Abbott and Fleming, or if they owe them a considerable sum of money? A. They paid some cash.

A. And gave them mortgages on the property for the remainder? A. I do not know that. I know that the sellers had negotiable papers besides cash.

Q. You know that the outstanding liabilities of this General Phosphate Corporation are very large? A. I have no reason to know it.

Q. Don't you know that they owe a lot of money? A. I have no reason to know it.

Q. Do you know it? A. You must remember that I gave in my resignation a month ago, and that they may have paid it all off since then.

Q. But a month ago? A. I have no idea.

Q. Can you give us no idea at all? A. No; not since last November.

Q. During last November how much did they owe? A. Stating from memory, we might have had a liability of eighteen or twenty thousand dollars.

Q. Would that be apart from the balance of the purchase money of these properties? A. I am speaking now when I say eighteen or twenty thousand dollars, of the money owing in Canada to merchants and for wages, etc.

Q. Apart from that, don't you know that it is largely indebted for the price of the property? A. That I don't know more than having a glance over the annual balance sheet. I know there is an indebtedness.

Q. A large indebtedness, too, for the price of the property they have bought? A. The largeness is comparative.

Q. Didn't this indebtedness in November for the price of the properties amount to somewhere in the neighbourhood of £40,000 sterling, or £50,000? A. I do not remember that it was as much as that.

Q. It was somewhere in that neighbourhood all told on all the properties? A. I do not know.

Q. I suppose the solvency of this Corporation depends altogether on whether this mining property turns out well or not? A. Yes; it depends on who works it.

Q. I suppose it depends also upon the quantity of phosphate that is to be found? A. Yes.

Q. So that if the phosphate trade does not turn out pretty well on these lots there is nothing for this Company to do only to go into insolvency—the usual fate of such Corporations? A. I suppose they fail—the natural consequence.

Q. A mortgage or hypothec given by such a Corporation would depend altogether upon the value of its mineral lands whether it was worth anything or not? A. To a large extent I should say it would.

Q. If those mineral lands were not worth the amount in the mortgages for which they were given as security, the vendor would virtually have no personal recourse against the Corporation that would be worth anything? A. I should say it would not apply to these properties. These properties are sufficiently rich in mineral wealth, but speaking generally I suppose it is so.

Q. I am asking you if these properties should not turn out to be very remunerative, is it not a fact that the vendor would have no recourse against the Corporation as a Corporation that would be worth anything? A. Probably so.

Q. Do you think that Mr. Stewart, if he had remained at home, and not gone to London, and had not employed people to assist him in the sale of this property, that he could have sold the property here for £18,600 that he has stated he received for it in cash as the net proceeds of the sale to the General Phosphate Corporation? A. It is ridiculous for me to give you any appreciation of that. If I had not gone across to the other side I do not think he could have made any sale at all.

Q. You do not think that he could have sold this property for £18,600? A. He would never have made a sale at all if I had not gone across to the other side.

Q. You said a little while ago that the sale was completed when you got there? A. I do not know.

Q. Didn't you say a little while ago that the terms of the sale to the General Phosphate Corporation had been virtually completed when you got to London in August, 1890? A. Yes; but I was in London before that period. I have been over five or six times now.

Q. Do you think that if those properties were put upon the market to-day and brought to sale in Canada—the properties that are referred to in Exhibit No. 1—that they would realize more than £18,600 in the condition they were in on the third of September, 1890? (Objected to as illegal and irrelevant, being completely foreign to the matter at issue in this case. Objection reserved). A. It is completely problematical.

Q. Well answer it? A. I do answer it: it is completely problematical.

Q. You are unable to say whether they would or not? A. If it was put into my hands for instance.

Q. Or if it was brought to sale by the sheriff to-morrow or a month hence do you think it would realize more than £18,600?

Objected to as above.

A. Not by sheriff's sale, that would depreciate it.

Q. But by private sale: if it was offered for sale at public auction do you think it would bring anything more in your opinion? A. It would depend on whose reports were backing it up and what brokers were handling it. It would depend upon the market price.

Q. Has not the phosphate industry greatly depreciated in the last couple of years? A. It may be up again next week.

Objected to as irrelevant.

Q. Has not the market value of phosphate lands greatly depreciated within the last couple of years? A. The market price of phosphate lands is always more or less fluctuating.

Q. At the present time the prices are down? A. Yes.

Q. And they have been down for a year or so? A. Yes; and may recover themselves to-morrow.

Q. In the present state of the market do you think these properties if offered for sale at public auction in the condition they were in in September, 1890, would bring £18,600?

Objected to as irrelevant.

A. Yes, I do.

Q. Would they bring more? A. Yes.

Q. You swear you think that? A. Yes, I think that.

Q. That is before any improvements were made upon them apart from the improvements that were on them in September, 1890? A. Yes. There were very few improvements made on them from the terrible way they had been worked.

Q. Had you an office in London during January, February and March, 1890? A. I had the accommodation of an office with my name on the door. Yes, I had an office in London.

Q. You had it in connection with somebody else? A. No.

Q. You were doing nothing else besides being in the interests of Mr. Stewart at that time? A. Yes, I was acting as independent mining engineer.

Q. Your services at that time were not exclusively given to Mr. Stewart? A. No, not exclusively, although my work at that time in London was limited to Canadian phosphate business.

Q. You did not limit your business by any means to the properties referred to in exhibit "A 1" during that period? A. No; there were others besides the High Falls property of Mr. Stewart. I could not sell them all.

CROSS-EXAMINED.

Q. What do you mean when you say that your occupation there was not exclusively limited to obtaining sale of Mr. Stewart's properties? A. There were other Canadian properties which were required to combine with Mr. Stewart's to make one successful undertaking—to wit Mr. Colby's which were acquired.

Q. Did you do there other work outside of the work which you were undertaking for Mr. Stewart, and if so, what was that work? A. It was the same kind of work, that is to say, the same brokers.

Q. And had you any other work? A. No other work except the specialty of Canadian phosphate properties.

Q. Your profession requires a special education? A. Yes.

Are there many mining engineers in Canada that are known in London? A. Yes: a great many but not Canadian.

Objected to as not arising out of the examination in chief, and that Mr. Wills is not the proper person to testify to his own value.

Objection reserved.

Q. Are there many mining engineers in the vicinity of Buckingham who are known in London and have the confidence of the London mining public? A. Not many.

Q. You yourself lived in London for some length of time? A. Yes.

Q. What did you mean when you said in your examination in chief that you may have had a conversation with certain people, namely, Messrs. Franchot, Mackintosh and Benson, about the commission paid or to be paid to Mr. Sando by the defendant? A. I do not remember having had a conversation with either of these gentlemen on that subject.

Q. Then what do you mean by saying that you might have had? A. But meeting them and seeing them so often, it may have transpired, or they may have suggested or inquired, or we may have had some conversation upon the subject in that way. Under oath I cannot deny flatly that I have never spoken of the commission to Mr. Sando.

Q. What do you mean when you say that the essential work of forming the Corporation, that is the General Phosphate Corporation, was done before you left London in March, 1890? A. Mr. Sando, who had been the figure head in the proposed amalgamation of Canadian phosphate properties in London at the time—I am speaking now of January, 1890—was receiving offers of properties to the extent of some 3,000,000 acres. The scheme was then known as the Phosphate Trust, and on my arrival in London in January, which was about the 23rd, I think, up to the time of my quitting it for South America, the middle of March, I was in constant communication with Mr. Sando—more particularly advising the selection of certain Canadian properties.

Q. You said that indirectly you may have contributed to the forming of the General Phosphate Corporation. What do you mean by that? A. I mean that the first scheme proposed by Mr. Sando as the Phosphate Trust was completely irrealizable, and from my counsel and advice to Mr. Sando, his whole plans were changed from the Phosphate Trust to the formation of the General Phosphate Corporation.

Objected to as not arising out of examination in chief.

Q. What do you mean by irrealizable? A. The first scheme had been so adversely criticized by financial and mining people both in London and in Canada, and properties of comparatively no value unknown to Mr. Sando had been misrepresented to him as good, and so on—that is what I mean by irrealizable; that it had been crushed by public opinion.

Q. You say "irrealizable?" A. I say it was not to be realized.

Q. You have stated that the capital of mining corporations chiefly consists of mining lands. Do you mean to say that these corporations usually invest all their capital, and keep no reserve? A. A well organized and well managed company would certainly keep ample reserve.

SOME OF STEWART'S EVIDENCE.

Q. You have stated that Mr. Wills, the Plaintiff, was not present at the time that the agreement, Plaintiff's Exhibit "A 1," was drawn up, dated the 3rd September, 1890. Is it not a fact that Mr. Wills was in the same building, in the adjoining room, and that you went to him for advice at that time? A. I have no recollection of it.

Q. Will you swear that such is not the case? A. No; I will not.

Q. Was a draft of this agreement, Exhibit "A 1," made previous to the 3rd September, the date on which it was signed? A. Yes; there was.

Q. When was that draft made? A. I cannot recollect the date.

Q. Is it not a fact that Mr. Wills was present in the same building, in the adjoining room, when the draft last spoken of was prepared, and that you on that occasion consulted him? A. I do not think so.

Q. You will not swear that you did not? A. No.

Q. When did you pay Mr. Wills the $2,141 on account of commission due under this letter of the 20th February? A. In different payments.

Q. About what dates? A. Mr. Aylen has the account of that. I cannot recollect the dates.

Q. Will you look at the account and state what are the dates? A. I produce the account of payments (fyled as Exhibit A 16.)

Q. At that time the Plaintiff had been Manager of the General Phosphate Corporation for some length of time? A. Yes; some little length of time.

Q. And I suppose you were aware of the fact? A. He said so himself.

Q. You mean that he told you so? A. Yes; he told me so.

CROSS-EXAMINED.

Q. Who is Mr. Sando that is referred to in the correspondence and letters produced with your examination in chief? A. He was the promoter of the General Phosphate Corporation.

Q. Is that the party who is referred to in Exhibit "A 13?" A. Yes.

Q. Did he take any part in assisting in bringing about the sale referred to in Exhibit "A 1?" A. Yes.

Q. What part? (Objected to as illegal and irrelevant, and as not arising out of the examination in chief, and as being inadmissible from the mouth of the Defendant himself.) A. He took the part of the promoter.

Q. How do you mean? Promoter of what? Of the sale? A. Promoter of the Company that purchased the property.

Q. Did he take any part in negotiating the sale? A. Yes.

Q. At whose request? A. At my request.

Q. Did he get any part of the proceeds of the sale for those services, and if so, what portion? (Objected to as irrelevant. Objection reserved.) A. Yes; he did. He got £11,000.

Q. How did you happen to make the arrangement with him to give him that amount? (Objected to as above.) A. I made an arrangement with him to sell the property for £29,000, and he sold it to the Corporation for £40,000. He was to keep what he got over the £29,000.

Q. Did he keep it? A. He did. (Objected to as above.)

Q. And the balance; what became of this £10,000 that was retained as security for the delivery of a certain quantity of phosphate in the City of Montreal? (Objected to as inadmissible from the mouth of the Defendant. Objection reserved.) A. The £10,000 was forfeited owing to my not fulfilling my contract, and I recived £1,000 cash and 3,000 shares as representing £10,000.

Q. That was the basis of your settlement with the Company? A. Yes.

Q. Have you any agreement of that nature with you? A. Mr. Benson is on his way out with those papers.

Q. When do you expect him? A. I expect him here to-day.

Q. What would be the value of this £3,000 of debentures? (Objected to as above.) A. They would not be of much value just now, as they are not on 'change, and not negotiable just now.

Q. Would they have any monetary value at present? A. I do not think so.

Q. It depends on the success of the enterprise? A. Yes. (Objected to as above.)

Q. What cash have you netted from the disposal of this property? (Objected to as above.) A. £18,600.

Q. After the payment of commissions? A. No; Subject to my commissions.

Q. That is over and above the commissions that you have paid? A. I do not understand your question.

Q. That is what you had left after you paid the commissions—after you paid for the disposal of the properties and the securities—after you paid Mr. Sando and the other parties? A. Yes.

Q. What do you mean in your examination in chief when you said you had "discontinued" your connection with the contract? A. Because the contract is taken off my hands.

Q. Have you no longer any connection with the General Phosphate Co.? A. No, not any connection in the contract.

Q. They relieved you of the contract? A. Yes.

Q. But in consideration of your giving up the £10,000 referred to in your contract they have given you £1,000 in money, and debentures to the extent of £3,000.

Objected to as above, and further as being leading and suggestive.

A. Yes.

Q. Where was the agreement made? A. In England.

Q. Through whom? A. Through Alexander Benson, my attorney.

Q. Who chiefly carried on negotiations for the sale of this property? A. Mr. Sando.

Q. Was it necessary that you should pay these commissions in order to dispose of the property at the rate it was disposed of?

Objected to as above.

A. Yes.

Q. Had you tried to dispose of it before cabling Mr. Sando? A. Yes.

Q. Had you succeeded. A. No.

Q. What cheque is referred to in exhibit "A 4," and what was it given for? A. I presume it was a balance owing to Mr. Wills for reporting on properties for me.

Q. Had you paid Mr. Wills anything for making reports in connection with any of your properties apart from what is referred to in exhibit "A 16" before that? A. Yes.

Q. How much had you paid him altogether? A. I do not recollect—perhaps $250 or $300, or somewhere there.

Q. That was before that? A. Yes.

Q. Had the services which you have referred to, or the dealings that you had with Mr. Wills in 1888, or thereabout, any connection with the services which were referred to in the letter, plaintiff's exhibit "A 1?" A. No.

Q. What was this sum of $250 or $300 that you speak of as having been previously paid to Mr. Wills paid for? A. For reporting on the High Falls property!

Q. Is that the property referred to in exhibit "A 1?" A. Yes.

Q. Is it included in this property? A. Yes, it is included in it.

Q. When you employed Mr. Wills in 1888 or thereabout, did you pay him for his services? A. Yes, I paid him for all his services.

Q. When were these reports made that you paid him for? A. In 1888 or 1889. I am not sure as to the year. It is thereabout.

Q. I notice in this letter exhibit "A 1" the following quotation: "In consideration of your professional services rendered." When had these services been rendered?

Objected to as illegal and irrelevant and not arising out of the examination and as inadmissible from the defendant.

Objection reserved.

A. It was in connection with his services rendered all along I suppose.

Q. When was it that Mr. Wills began to render the services which are referred to in this letter—how long before the signing of that letter? A. I could not say how far back they refer to.

Q. About how long? A. It might have been six months.

Q. Did you ever request Mr. Wills to be present at the signing of this contract exhibit "A 1?" A. No, I have no recollection of ever asking him.

Q. Did you ever ask him to take part in the preparation of it. A. No.

Q. Who saw to the preparation of it? Who got up the contract? A. My solicitor and the Corporation's solicitor.

Q. Who were looking after your interests at the time? A. Hooper & Babcock, my solicitors.

Q. Did Mr. Sando take any part in it? A. Yes.

Q. At your request? A. Yes, at my request.

Q. Was he looking after your interests when it was being prepared? A. Yes.

Q. When you paid Mr. Wills the other items which are not referred to in exhibit "A 16," did you pay him by cheque or in what manner? A. I paid him both by cheque and by money delivered.

Q. Did you take receipts for them? A. Yes.

Q. Have you got them in your possession now? A. Not here.

RE-EXAMINED.

The amount which you have paid to Mr. Wills on account of commission due under exhibit No. 1, is as you have stated in your examination in chief, I believe, the sum of $2,141.30? A. I paid him $2,171.

Q. But the sum paid on account of the commission was as stated by you in your examination in chief $2,140? A. About that.

Q. You and Mr. Wills had other little transactions I believe during the year 1891? A. I do not know what transaction you refer to.

Q. Of a personal nature—small transactions, money which Mr. Wills has advanced to you? A. Has advanced for me?

Q. Yes? A. I do not know of it.

Q. Will you please look at the account now shown you as plaintiff's exhibit "A 17" and state if the charges therein mentioned, of $2.45, $3.25, $4.25, $5, $9.62 and $3 are amounts that were paid by Mr. Wills for your benefit?

Objected to as irrelevant having nothing to do with the present action. Objection reserved.

A. Mr. Wills did not pay all this money for me, on my account.

Q. On whose account did he pay it? A. Some of it on account of the Corporation.

Q. Is it not a fact that you and Mr. Wills had an account current between you during the year 1891 altogether apart from this question of the commission due him on this transaction? A. I do not know that.

Q. Is it not true that Mr. Wills advanced certain sums for you in connection with the account of one Brasseau, which sums you paid him pack?

Objected to as irrelevant to the present issue.

Quirk vs. New Rockland Slate Co.

The plaintiff was appointed expert by the court to act with two others in a suit to which the defendants were parties. He now brought suit for his fees. The defence was that the action was prematurely brought because the action was still pending. The court held, however, that experts are not obliged to wait for the payment of their fees until the case is decided. The plaintiff got his bill taxed, which has the force of *chose jugee*. Judgment in favor of plaintiff for $353.50.

Duty on Coal Oil.

(Proceedings House of Commons, 30th May, 1892.)

Mr. MACDONALD (Huron) (for Mr. CAMPBELL) moved for:—

"Return showing the quantity of coal oil, and also kerosene oil, imported for consumption in Canada from the 1st day of July, 1891, up to the 1st day of May, 1892. Also, the amount of duty collected on the same."

He said: The coal oil question has now become one of great importance, and we hear much about it in election times. The people complain of the excessive price of coal oil in this country compared with the price of that article on the other side of the line. As a large amount of coal oil is used in this country, more particularly by the working classes and the farmers, and as the residents in towns and cities have resorted largely to electric and gas light, therefore a large additional expenditure falls upon the poorer classes of this country who use coal oil. I am not opposed to the National Policy in respect to coal oil, because free trade in oil would be unjust to the oil men; but I am opposed to the excessive duty of over 100 per cent. in favour of the coal interest, because this enables them to control the whole industry, and gives them a monopoly in the industry of refining oil. When we consider the quantity of oil used in this country, the excessive duty becomes a very heavy burden upon those who use coal oil. I consider that the refiners of Canada have a monopoly in the industry of refining oil, and this monopoly imposes a much higher price upon that article than they would be able to do if the duty was reduced considerably. The duty now is $7\frac{1}{5}$ cents per gallon. We imported in 1890-91, 5,070,000 gallons, according to the Trade and Navigation Returns, upon which we collected $365,000. Now, it would be supposed, at first glance that $365,000 was the amount of duty paid, but that is not the fact. The duty on coal oil is $7\frac{1}{5}$ cents per gallon, then there is 1 cent for inspection, and 1 cent rate on barrel, which makes $9\frac{1}{5}$ cents protective duty on coal oil in favor of the refiners of Canada. The amount comes to $466,000 between the duty direct and payment for inspection and duty on barrels. Coal oil is imported from the other side by wholesale dealers. They are supposed to make their price on the cost of the article, together with the duty and other charges. The profit of the wholesale importer, 20 per cent., which is the ordinary price charged, will amount, on a total duty and charges of $466,440, to $93,288, which would make the duty and the increased price, by reason of the duty, before it leaves the hands of the wholesale importer, $559,728. The oil passes from the wholesaleman to small dealers, and they, of course, place on an average 40 per cent. of profit on the article owing to the difficulty of keeping oil, and the heavy insurance involved. 40 per cent. on $559,728 gives $223,728, which will be charged as profit on the original duty and the profit of the wholesale merchant, which would make the total, by reason of the duty, $783,639, or nearly 15½ cents per gallon. Suppose the duty was wholly removed, the account would stand thus: The original cost of No. 1 white American oil at the present time is 7 cents per gallon in Buffalo.

Mr. SPROULE. Is that wine gallon or imperial gallon?

Mr. MACDONALD (Huron). Imperial gallon.

Some hon. MEMBERS. No.

Mr. MACDONALD (Huron). It is not wine gallon, which is somewhat less than imperial. Placing the profit of the importer at 20 per cent., the cost would be increased by 1·4 cent, and giving the small dealers 40 per cent. profit, as I did in the other case, it would amount to 3·4 cents, which would place the cost to the retailers at 11·8 cents per gallon if the duty were removed. If you add 11·8 cents to 15·4 cents, the exact figures in the other case, you get 27.24 as the price of American oil sold in the Canadian market. It will thus be seen that my calculation is perfectly correct, because from 27 cents to 30 cents per gallon is the price of American oil at retail in the Canadian market. Some accounts put in by the Government showed that the American oil cost them 30 cents per gallon. Let me give another calculation. It will thus be seen that the increased cost of imported oil is $783,639 by reason of the duty. How much do we increase it by reason of the increased price when the duty enables the Canadian manufacturers to put on as an extra price by reason of this duty by which they are protected? The Canadian people consume about 15,000,000 gallons of coal oil, 10,000,000 gallons of Canadian, in addition to 5,000,000 imported. The wholesale price of Canadian oil at the present time is about 11½ cents, or rather it was 12 cents when I obtained the quotation. Supposing the duty were reduced, we would at least bring American oil down to the same price as Canadian oil, because Canadian oil is of a much inferior quality. We would, therefore, obtain it at 7 cents per gallon wholesale if we could obtain American oil for 7 cents in American markets: that is to say, 11 cents higher than the price for which we would be able to obtain it if we had reciprocity, or 4 cents more than if we had a reasonable duty—60 or 70 per cent. instead of 100 to 125 per cent. The total cost of the 10,000,000 gallons of Canadian oil in the wholesale market would be $1,200,000. I exclude from this calculation the wholesale merchants, beeause Canadian retailers generally deal direct with Canadian refineries. and the middlemen do not appear so much as dealers in the Canadian article as they do with respect to American oil. Taking 40 per cent. profit to retailers on this sum of $1,200,000, we have $480,000 as the increased price of the oil, by reason of the duty, which is given to the Canadian refiners as a protection. This brings the selling price up to $1,780,000. If the price of Canadian oil were to fall 7 cents, the price of American oil, the total amount at wholesale price and 40 per cent. profit would be $980,000, as compared with $1,680,000, or a saving to the Canadian people on Canadian oil alone of $700,000. Adding that $700,000 to $783,639, which is the amount paid as duty and inspection and duty on barrels by the Canadian consumer on imported oil, we have a total amount as the result of the duty of $1,473,639. We will be met with the argument that this large duty is necessary to sustain and develop the oil industry in Canada. A few words, therefore, in regard to that industry will be in order. In 1881 the refineries of Canada employed 379 men. According to the last census bulletin, No. 8, the oil refineries of Canada, numbering 20, employed 270 men, or after ten years of protection, 109 less than in 1881. Again, it would pay the Canadian people to superannuate every man who is engaged in the refining business in this country. What would be the cost? We have 270 men to deal with. The average wages of mechanics in cities and towns in 1889 was $447. So these 270 men would earn $120,690 a year. Suppose the country undertook, in addition to superannuating the men, to buy up all the tools and machinery in those refineries. According to the last census bulletin, the value of machinery and tools in those refineries was $516,510. Further, it would pay the country to pension every one of the refiners at $10,000 each. There are 20 refineries, and accordingly the sum required would be $200,000. The total cost, first, of superannuating the men; second, of purchasing the machinery and tools of the refineries; and third, of superannuating every refiner, would be $836,200, or a saving of $647,439. No hon. gentleman on either side of the House can fail to see the fallacy of protecting an industry which collects from the people such a large sum of money as does the coal oil industry, and, as I said at the beginning of my remarks, although I am favourable to extending to these men a reasonable protection, it is wrong, I think, in the interest of the consuming population of this country, to extend to the refiners a protection of 100 or

125 per cent. I believe that the Government should take this matter into their serious consideration, and determine whether the oil refiners of this country should receive more protection than the average manufacturers in the other districts in Canada. If the Government should come to the conclusion to reduce the duty on coal oil, they will be doing what is largely in the interests of the people, who are obliged to use a large quantity of coal oil every year. It is an article of prime necessity, it is not an article of luxury ; it must be used by the masses of the people, and it should therefore be placed at their disposal at as cheap a price as possible. It was stated in the House last year that the lowering of the duty on sugar removed a burden of taxation off the shoulders of the people. The result of that very good act on the part of the Government was that the price of sugar fell in the market, and the consuming public were able to buy it cheaper. In the same way, if the Government should reduce the duty on coal oil from 7½ to, say, 5 cents a gallon, it would relieve the people of at least one third of the burden which they are now obliged to bear in this matter. I am quite sure that if the duty were lessened the people would receive a corresponding benefit. It was for that reason that I moved for these papers, so that we may learn whether as large a quantity of coal oil is imported as before, and also for the reason that the matter may be brought to the attention of the Government. I hope they will consider this question—not upon the basis of free trade, because I do not contend that coal oil should be put upon the free list ; for so long as we have the National Policy in this country, it is only right, and equitable, that protection should be given to the oil producers as well as to every other industry, along the lines of justice. I, therefore, trust that the Government will try to see their way clear to reduce the duty upon coal oil to 5 cents a gallon.

Motion agreed to.

Recent Amendments to the Mineral Act of British Columbia.

The following excerpts from the Mineral Act, as recently amended, are of interest :—

Sec. 11 of the Act, as amended, limits the free miner's right to cut timber to "such timber as may be required for the purposes of the claim or claims worked by him alone, or by him in partnership with another or others."

Secs. 14 and 15 have been repealed and are replaced by the following, to which careful attention should be given by every prospector :—

"14. Any free miner desiring to locate a mineral claim shall, subject to the provisions of this Act with respect to land which may be used for mining, enter upon the same and locate a plot of ground, where possible not exceeding 1,500 feet in length by 1,500 feet in breadth, in a rectangular form, that is to say, all the angles shall be right angles, but the lines need not necessarily be meridianal. In defining the size of a mineral claim it shall be measured horizontally, irrespective of inequalities on the surface of the ground.

"15. A mineral claim shall be marked by two posts, each post being at least 4 inches square and 4 feet above the surface of the ground. The posts shall be numbered 1 and 2, and upon each post shall be written the name given to the mineral claim, the date of the location and the name of the locator. Upon No. 1 post there shall be written, in addition to the foregoing, "Initial post," the approximate compass bearing of No. 2 post, and a statement as to whether the claim lies to the right or left of the line from No. 1 to No. 2. Thus : '(Name of claim),' '(date),' 'A. B.'s claim,' 'Initial post,' 'direction of No. 2, northeast,' claim lies to right (or left) of line from No 1 to No. 2 post.

"It shall not be lawful to move No. 1 post, neither shall it be lawful to move No. 2 post, except for the correction of distance by the Provincial Government surveyor. Nos. 1 and 2 posts shall govern the direction of one side of the claim.

"(a). The owner of a mineral claim shall be entitled to all minerals which may be within his claim, but he shall not be entitled to mine outside the boundary lines of his claim continued vertically downwards.

"(6). This Act shall not prejudice the rights of claim owners who have located their claims under former Acts."

Sec. 24 is amended to allow work done outside a claim to count as assessment work, provided the Gold Commissioner is satisfied it is a bona fide development work. This section also now gives partners right to do statutory the assessments for all or any one of a group of claims, provided they file a declaration of their intention with the Gold Commissioner.

Sec. 25 now reads : "In case of any dispute as to the title to a mineral claim, priority of record will determine the right, subject to any question as to the validity of the record, and subject also to the compliance by the free miner with the provisions of this Act.

Sec. 37 is amended so as to lay more on the shoulders of an adverse claimant. Such claimant must now, without any demand on the part of the defendant, "show, with reasonable particularity, the nature, boundaries and extent of such adverse claim."

By Sec. 56 the plan of a claim required, when a certificate of improvement is applied for, must now be made by an authorized land surveyor.

These are some of the main changes. A section now entitles the free miner to a copy of the amended Act on payment of 25 cents.

Nova Scotia's Increased Royalty.

Coal Lessees : "But our leases explicitly state that the rate of royalty is fixed for the current term. How can you increase it at will without a breach of faith ?"

Premier : "Needs must when the devil drives ; and you must understand the Legislature of Nova Scotia has the power to break a contract or to take your property without compensation ; but I may tell you the Attorney-General says there is no breach of faith."*

Coal Lessees : "We are differently advised, still, so content are we that moral justice and right is on our side that we are ready to leave the question to arbitration or the Courts. Will you agree ?"

Premier : "No ; the Supreme Court sometimes makes mistakes."*

The Premier of Nova Scotia is now in England seeking to raise money on the good faith of the Legislature of Nova Scotia.

Mineral Resources of the Yukon and Mackenzie Districts—A Great Petroleum Field—Promising Alluvial Diggings.

Contributed by A. M.

North of the great plains, along the Athabasca, Peace, and Mackenzie rivers, are situated a number of petroleum districts, the total area of which probably exceeds that of all the known oil fields in the world combined. On the Athabasca indications of gas and oil occur along the valley for a distance of over two hundred miles. The basement rocks here consist of petroliferous Devonian limestones. Resting on these is a thick stratum of soft sands of Cretaceous age, which has been blackened and cemented into a coherent tarry mass by the floods of oil which have welled up in bygone ages from the underlying limestones. The tar sands are first seen in descending the Athabasca, at the Boiler Rapid, or about 170 miles below the "Athabasca Landing," and are there present in bluffs along the valley for a distance of over eighty miles. They have, according to the reports of the Geological Survey, a thickness of from 150 to 225 feet, and outcrop at the surface over an area of about a thousand square miles. The tar sands themselves, where exposed, although 15 to 20 per cent. of their bulk consists of bitumen, are not supposed to have any great commercial value, as the lighter oils have long since volatilized away, and only the heavier constituents remain. In the upper part of the vein, however, where they are buried beneath the later cretaceous divisions, it is highly probable that the oil remains in its original condition, but the solution of this question depends upon a generous use of the drill.

West of the Athabasca river tar springs are reported on Lesser Slave Lake, and are also known to occur on Peace river. The latter are thus described on Page 11., Summary Report of the Geological Survey for 1889. Inspissated petroleum lining cracks in calcareous nodules was found along Peace river for some sixty miles below the Peace river landing. At Tar Island, about thirty miles below the mouth of Smoky river, there is a saline spring which is kept in a constant state of ebullition by the escape of natural gas. Small quantities of tar line the sides of the spring and float on the surface of the water. This spring, and a couple of others which are reported nearby, are situated near the axis of a broad flat anticlinal, one of the essential conditions of a successful oil field. Gas and oil in paying quantities are most frequently found in these great natural domes, and the only element of uncertainty in this district is the presence or absence of some porous formation to act as a reservoir. It is possible that the loose sands found along the Athabasca extend this far, or that some equivalent formation occupies their place ; but as natural sections are wanting, this can only be proved by artificial sections obtained by boring.

North of the Athabasca oil region, tar springs are known to occur along the northern shore of Great Slave Lake, and petroliferous limestones floor the valley of the Mackenzie nearly all the way to its mouth. At Fort Good Hope, a few miles south of the Arctic Circle, are situated the tar springs from which the Hudson Bay Company obtain the pitch used by them for boat building purposes.

Favorable indications of the presence of oil, in the shape of tar sands, tar springs, effusions of natural gas, and petroliferous limestones, are thus seen to characterize the country bordering on the Mackenzie-Athabasca valley for a distance measuring from the south to north of over a thousand miles. It is highly improbable that productive oil beds are continuous throughout the whole of this vast region, but there is every reason to believe that over a considerable proportion of it the oil is sufficiently concentrated to be of economic value. Up to the present time the remoteness of these northern oil fields from the centres of civilization has prevented any attention from being directed towards them, but the expected completion of the Calgary and Edmonton Railway during the coming summer will place them within a reasonable distance from railway communication, and they will probably soon take their place among the oil producing regions of the world.

West of the Rocky Mountains, in the great country drained by the Yukon and its tributaries, the geological conditions are entirely different from those prevailing in the Mackenzie Basin. This region lies in the auriferous zone which borders the western part of the continent, and the gold-bearing belt, according to the reports of the members of the "Yukon Exploring Expedition," appears to have lost none of its wonderful richness in its extension northwards. Miners entered the district about the year 1881, and the prospecting which has been carried on since then has shown that gold is of almost universal occurrence, although only in some places is it found in sufficient quantities to be profitably worked in the face of the high prices prevailing for labour and provisions. Stewart River and Forty Mile Creek are the richest streams so far discovered. The former yielded over $100,000 worth of gold to a handful of miners during the years 1885-86, some of the bars paying as much as $100 per day per man. The gold on Forty Mile Creek is reported to be richer than that on the Stewart, but the greater part of this stream lies in Alaskan territory. The following extract from Dr. Dawson's report will afford some idea of the present condition and future prospects of gold mining in the Yukon country. (Annual Report Geological Survey of Canada, 1887-88, Part I., page 182) :

"Mining can scarcely be said to have begun in the region more than five years ago, and the extent of country over which gold has been found in greater or less quantity is already very great. Most of the prospecting has been confined to the banks and bars of the larger veins, and it is only when these innumerable tributary streams begin to be closely searched that 'gulch diggings,' like those of Dease, McDame, and other streams in the Cassiar district, and possibly even on a par with Williams and Lightning creeks, in Cariboo, will be found and worked. The general result so far has been to prove that six large and long veins, the Dewes, Tet-lin-too, Big Salmon, Pelly, Stewart and White, yield "fine gold" along hundreds of miles of their lower courses. With the exception of the Lewes, no part of the head waters of any of these have yet been prospected or even reached by the miners, and scarcely any of their innumerable tributaries have been examined. The developments made up to this time are sufficient to show that when means of access are improved, important bar mining will take place along all these main rivers, and there is every reason to anticipate that the result of the examination in detail of the smaller streams will be the discovery of much richer auriferous alluviums. When these have been found and worked, quartz mining will doubtless follow, and the prospects for the utilization of this great mining field in the near future appears to me to be very promising."

The Yukon district remains as the last refuge of the placer miner. These pioneers of mining enterprise have gradually advanced northwards, following the auriferous belt from California through Oregon, Washington Territory, and British Columbia, and are now spreading themselves in the face of difficulties and dangers from which all but the bravest and strongest quail over this inhospitable region. In the progress of their work the metalliferous lodes from which the loose gold has been derived will, as in other districts, be gradually discovered, and mining ventures of a more solid character will follow.

Extraction of Ore from Wide Veins or Masses.*

By G. D. Delprat, London, Eng.

The object of this paper is to describe an application of the cross-cut system of mining, as carried on in the Cabezas del Pasto mine, one of the copper mines in the south of Spain. The system is not new, but it is not very generally adopted. It offers, however, decided advantages over other systems more in use : especially where the ore is found in large masses or wide lodes, it allows the extraction of all the ore without leaving any pillars or roofs. A somewhat detailed description of the various operations and costs of working may not only be interesting, but may possibly lead to a more general adoption of this method in cases where at present the pillar-and-stall system is preferred.

The copper-lodes in the south of Spain and Portugal are the following : They are nearly all lenticular masses of great lateral dimensions and unascertained depth ; their direction is approximately east-west, and their dip towards north. Some are contact-lodes, having slate on the hanging-wall and porphyry on the foot-wall ; others are imbedded in porphyry, and others again are imbedded in clay-slate.

The upper portion of these lodes consists of "gossan," a siliceous peroxide of iron, mixed with more or less clay. The depth to which the gossan goes down varies in different localities from 40 feet to 120 feet and more. Below the gossan is found the iron-pyrites, with about 2 to 3 per cent. of copper. The gossan is generally admitted to be the result of the decomposition of the pyrites, the copper rendered soluble, filtering into the underlying layers of undecomposed ore, and enriching the ore below the gossan above the general average. Very rich pockets and streaks of ore, containing sometimes 10 per cent. of copper and more, are often found in the upper portions of the lodes. The copper contained in the ore is generally in the shape of gray and black sulphides and copper-pyrites ; rich pockets often show chalcopyrite and fahlerz. In nearly all the mines the ore has been found to get poorer in copper with greater depth ; a cross-section through the Cabezas del Pasto mine shows this diminution, and may be taken as a fairly representative case. The greater the lateral dimensions of a deposit, the greater is generally the depth down to which a fair percentage of copper is found.

In the Rio Tinto mines, which are the largest copper mines in Spain, a depth of 700 feet has been reached in

*Actual expressions used.

* Transactions of the February meeting of the American Institute of Mining Engineers.

some places without any marked decrease in copper contents; but the length and width of the Rio Tinto deposits are enormous, one of them being more than half a mile in length, and in some places more than 300 feet wide—all solid ore.

In the Tharsis mines, the next in importance, poor ore has been found at much less depth, the lateral dimensions of the deposits being smaller. In most of the smaller mines the ore gets too poor to be worked at a profit at a depth less than 300 feet. One per cent. of copper is generally taken as the limit of workable ore.

The following is a complete analysis of a fairly representative sample of ore from the Rio Tinto mines:—

Sulphur	48·3
Copper	3·44
Iron	43·33
Bismuth	·02
Lime	·34
Lead	1·00
Gold	·00005
Silver	·004
Cobalt	·05
Arsenic	·75
Antimony	·07
Calcium oxide	23
Manganese	·05
Silica	1·89
Moisture	·48
Selenium	traces.
	99·95405

There are some exceptional deposits which are of a different nature, such as the "Esperanza," near Tharsis, where the copper is found as a sulphide impregnating the slate, but they need not here be mentioned.

The ore is generally sorted by hand into two classes. The richer ore is sent to England and the Continent, to the sulphuric acid manufacturers (who, after burning off the acid, send the residue to the copper works), and the purer ore is generally treated for copper only in proximity to the mines.

Two systems of mining are very generally adopted.

When the gossan is comparatively shallow and the mineral mass is wide, the ore is generally got by open-cast working; the overburden is removed in benches about 30 feet high, and the ore thus laid bare is quarried.

The cost of removing the overburden varies with the nature of the ground and with the facilities for getting proper dumping facilities. The following statement shows the average cost over a whole year in the "Joya" mine, which is worked by the open-cast system. The greater part of the material removed is decomposed porphyry, and, as a rule, fairly hard.

Cost of Removing Overburden at the "Joya" Mine, per Cubic yard in the Solid (calculated on the total quantity removed during 1891).

Labor.—	Superintendence	$0.009	
	Excavation	0.032	
	Loading into waggons	0.049	
	Mule-drivers	0.005	
	Unloading waggons and repairing roads	0.016	
	Various	0.001	—$0·112
Materials.—	Explosives		
	Baskets (used for loading waggons		
	Railway material		
	Waggon "		
	Oil and grease		
	Various		— 0·011
Shops			0·006
Stable expenses (mules)			0·013
Tools			0·003
Amortisation of railway material			0·005
Total cost per cubic yard			$ 0.15

The open-cast working is certainly the best system in mines where the overburden is shallow and the deposit wide. The limit at which the removal of overburden becomes unprofitable is generally put at 4 cubic yards of overburden for every ton of ore laid bare. The cost of quarrying the ore, after having laid it bare, may be taken as follows, exclusive of general charges:—

Cost of Quarrying Ore in the Open-cast in the "Joya" Mine per Ton of 1000 Kilos (Average for the Year 1891).

Breaking the Ore.—	Miners	$0.038	
	Materials, explosives	0.012	
	Shops	0.004	
	Tools	0 005	—$0.059
Loading into waggons			0.038
Weighing			0.003
Total cost per ton, put into waggons and weighed			$0.10

Examples of open-cast working are found at the Rio Tinto (south lode), Santo Domingo, Tharsis (north lode, Sierra Bullones, and centre lode) La Zarza, La Joya, Las Herrerias, Lagunazo, etc.

When the proportion of overburden is too great, the mine is generally worked on the pillar-and-stall system. The lode is divided off vertically in floors, 30 to 40 feet apart, and in each of these floors galleries and cross-galleries are driven, intersecting one another at right angles, leaving large pillars of mineral to support the roof between the floors. The roof is generally left about 12 to 15 feet thick, and the square pillars have sides of 15 to 20 feet, the galleries being of the same width as the pillars, and about 20 feet high. It is evident, that by adopting this system of working, a large quantity of ore is left in the mine; taking floors 35 feet apart, with a roof of 12 feet, galleries 23 feet high and 16 feet wide, and pillars with sides of 16 feet, the quantity of ore extracted by means of the galleries is only one-half of the total quantity. In several mines considerably less than one-half is extracted. It is generally maintained by those who adopt the pillar-and-stall system that after honey-combing the mass, more ore may be gained by robbing the pillars and roof. This is, however, a very dangerous operation in mines where the lode is nearly vertical, where the width is considerable, the ore very heavy (specific gravity about 5), and where often ten to twenty floors are formed one above another. Only in one mine (the Carpio mine) has this been done, and the result was not encouraging. Only four floors had been formed, yet, although a good deal of ore was extracted by robbing, still, by far the greater part remained in the mine, and could not be got out, the comparatively great height of the galleries being a great element of danger. That the operation of robbing is a very delicate one is confirmed by the fact that most of the mining companies, after extracting all the ore they could get by means of galleries, and finding their ore reserves disappearing, have determined, instead of robbing the pillars, to remove the overburden and quarry the honey-combed mass in the open air. Instances of this are found in many places. It is needless to say that a great deal of money would have been saved if the overburden had been removed from the beginning.

Another disadvantage in connection with the pillar-and-stall system is the great cost of breaking the ore. Although galleries may be driven of considerable dimensions as long as the ore is firm, still, breaking ore in galleries, especially in hard ore, is always very costly. Whilst the breaking of ore in the open-cast may cost $0.07 per ton, the breaking in galleries will cost, on an average, from $0.52 upwards. When the orc is very hard it may be as great as$0.85. The reasons for this higher cost are too evident to need any mention. A miner will break per shift, in galleries, about ¾ of a ton; in the open-cast he will break from 12 to 15 tons of ore, and even more in favorable cases.

Examples of pillar-and-stall workings are found at Rio Tinto, in the San Dionisio lode; at Tharsis, in part of the north lode, and formerly, in the Sierra Bullones and La Zarza Tharsis (both these lodes are now open-cast); at Lagunazo, in the eastern portion of the lode, at Sotiel-Coronado, Pena de IIierro, Lapilla, Aznalcollar, Coridad, etc.

The Cabezas del Pasto mine is worked on a different system, which allows all the ore to be extracted without any danger and at a low cost; and there seems to be no reason why the system should not be adopted in all places where the pillar-and-stall is now used, and where the height of overburden excludes the open-cast system. The mineral deposit at this mine is about 500 feet long, with a width varying from 20 to 75 feet, the average being about 32 feet. The gossan goes down about 100 feet, and it was, therefore, impossible to work the mine by open-cast. The lode is nearly vertical and approximately in the centre of the mass.

After fairly ascertaining the bearing and extent of the lode, an extraction-shaft and a pumping-shaft were sunk in positions outside of the lode. The dimensions of these shafts were 10 feet by 5 feet and 11 feet by 5 feet. The extraction-shaft was divided by a partition in the centre, so as to accommodate two cages. They were originally sunk to a depth of 230 feet, and subsequently deepened to 350 feet.

The lode was then divided in floors about 65 feet apart. From the extraction-shaft galleries were driven at every floor, cross-cutting the lode entirely. When these galleries reached the ore, narrow galleries were driven east and west, following the hanging-wall (the extraction-shaft being in that wall), along all the sinuosities of the lode, and accurately determining its shape. From these galleries, again, cross-cuts were driven through the lode at every 33 feet. After thus learning the exact shape of the lode, a "side-tie" was driven in the country-rock, alongside the lode and at an average distance of about 15 feet, and from this side-tie cross-cuts were driven towards the lode at regular intervals of 33 feet. The side-tie was kept nearly straight and was used as an extraction-gallery; a tramway of 2-foot gauge, with rails of 30 pounds to the yard, being laid in it. There were various reasons why the gallery along the wall of the lode was not utilized as an extraction-gallery, the two principal ones being its crookedness, and the fact that it became surrounded by "stowing" or "gobbing," which necessitated constant timbering to keep it open. On one of the levels it was, indeed, attempted to make this gallery serve for extraction, but it was found very difficult and expensive, and quite unsuitable.

Both walls of the lode are slate, in which all galleries had to be closely timbered.

When the cross-cuts from the gallery along the hanging-wall had reached the foot-wall they were filled with stone carefully piled up, and new cross-cuts were then driven alongside the first ones; these were again filled up, and again new ones were made, and so on until a complete slice of ore had been removed over the whole length and width of the deposit. All the galleries and cross-cuts had a uniform size of 6 by 6 feet, so that the height of the first slice removed was 6 feet. When this had been accomplished the gallery along the hanging-wall was filled up and a new gallery was driven right above it. From this new gallery cross-cuts were again driven through the mass and filled up the same way as below, but with one important difference: while the first slice of 6 feet had to be broken out of the solid body of ore, the slice next above was now under-cut over its whole area, in fact it was resting on the packing. This made the blasting very much cheaper; so that, whereas the contract price given to the miners in the first slice averaged $0.50 per ton of ore, it was only $0.25 in the slice next above. Again, in the first slice the first cross-cuts in the solid ore cost $0.76 per ton of ore, and the secondary cross-cuts, which were really widening out the first ones, only cost $0.42 per ton. These figures show the enormous advantage of having free sides for the working faces—an advantage, by the way, which is never got in working by pillar-and-stall. After the second slice had been removed a third was taken away in the same manner, and so on until the whole lift of 65 feet was removed. The working was not limited, however, to one lift or level, but three were attacked simultaneously in the same manner; and at the present day the second, third and fourth levels are in active work, and the fifth is in preparation.

It might be expected that some difficulty would be experienced when workings of one floor reach the stowing of the floor above. In practice, however, it is found that the stowing gets so tightly packed as to be quite firm, and with a little additional care it is comparatively easy to mine below it. No galleries nor cross-cuts were made more than 6 feet high and 6 feet wide, and no new cross-cut was started before the adjoining one had been properly filled in.

During the filling-in of the gallery on the hanging-wall a chute was built up in rough stone, above the cross-cut, from the side-tie. Through this chute the ore from the second slice was thrown down to the cross-cut. When the second slice had been removed and the next gallery filled in, these chutes were carried up, and so on; and these always served for sending the ore down to the cross-cuts, and thence to the side-tie, where the ore was loaded into wooden hutches holding about one-half ton each, and subsequently trammed to the extraction-shaft.

The material used for stowing is quartzite. This is quarried on the top of a hill, about 700 yards from the lode. The stone is lowered by means of an inclined plane to the level of the mouths of two special shafts sunk for the purpose of delivering stone to the workings, and extending at present to the third level, with loading platforms at each floor. The stone, loaded in hutches similar to those used for the ore, is lowered in these shafts by means of double drums, with brakes, the full waggon going down pulling up the empty one. The stone required in the fourth level is landed in the third level and trammed through the extraction-gallery of this level. This extraction-level is connected with the workings below by means of winzes; the stone is tipped into the winzes and falls almost at the foot of the workings to be filled up. As the slices are removed these winzes get filled up also, and therefore gradually disappear, while the ore-chutes always get longer. Each level is thus supplied with stone from the floor above, and the stone need never be raised by hand. All the winzes for throwing down stone are made in the hanging-wall; they are about 3 feet square and very securely timbered.

A good deal of small stuff is produced in the quarry. At various times trials were made to use these smalls in filling up, as it seemed a pity to throw them away. It was found, however, not economical to do this, as the smalls were more expensive to handle in the mine than the big stones, and also because stowing done with smalls settles down far too much, and loosens the ore above to a dangerous extent, making a very treacherous roof in the workings higher up.

The stowing with large stones is so firm that no subsidence of the ground over the mine can be noticed, although a very large quantity of ore has already been removed.

This system has now been in operation for eight years, during which a total of 236,000 tons has been extracted. Only one man has been killed by falls of the roof during all this period, which shows that the system is not a dangerous one. All the cross-cuts are kept narrow (6 feet); very few props are used, and even these few are generally taken away before stowing.

The average quantity of ore broken by a miner in this mine is 3 tons per shift of ten hours, as against ¾ ton under the pillar-and-stall system, the difference being due to the ore being always under-cut and requiring little blasting.

The average cost of work in 1891 was, for different parts of the system, as follows:—

	Per Ton
First cross-cuts in the solid ore	$0.76
Cross-cuts	0.42
First cross-cuts in next slice	0.28
Following cross-cuts, etc	0.24

This shows the increased economy in breaking when the ore is under-cut.

The cost of extraction for the year 1890 was as follows:—

Cost per Ton, apart from General Expenses.

Labor.—	Superintendence	$0.0128	
	Breaking the ore	0.2372	
	Loading into waggons and tramming	0.0501	
	Engine-men, etc.	0.0362	
	Stowing	0.1569	
	Timbering	0.0152	
	Unwatering	0.0048	
	Various	0.0078	—$0.521

Shops.—Carpenter shop	0.0091	
Smithy	0.0148—	0.024
Materials.—Explosives	0.0436	
Coal	0.0353	
Timber	00.331	
Steel	0.0022	
Caskets	0.0074	
Grease	0.0078	
Various	0.0031—	0.132
Tools	0.0091	
Depreciation of machinery	0.0273	
" waggons and rails	0.0035—	0.040
Total per ton		$0.717

The cost of stowing per cubic yard may be detailed as follows, one cubic yard corresponding to about 2·7 tons of ore :—

Cost per Cubic Yard for 1890.

Superintendence	$0.0114
Quarrying stone, inclusive of explosives	0.0556
Throwing small stuff over dumps	0.0540
Transport of stone to shafts and lowering down in shafts	0.0931
Underground transport from shafts to winzes and topping	0.0654
Underground transport from winzes to workings	0.0720
Building up in workings	0.0360
Various	0.0164
Total per cubic yard	$0.40

For the better appreciation of these cost-sheets I may eere give the average daily wages earned by workmen in in the district :—

Wages Earned Per Day.

	Reals.	Dollars.
Foreman of the mine	24	1.00
Engine-drivers	20	0.87
Stokers	10	0.43
Carpenters	20	0.87
Smiths	20	0.87
Masons	16	0.70
Miners	12 to 16	0.52 to 0.70
Trammers	12	0.52
Ordinary laborers	10	0.43
Boys and girls	6 to 8	0.26 to 0.35
Cost of coal	150	6.54
" firewood	45	2.00
" six foot props, each	10	0.43

The following is the cost of a ton of ore, mined by the pillar-and-stall system, where other conditions are the same as above :—

Cost of Pillar-and-Stall System Per Ton of Ore.

Labor.—Superintendance	$0.0128	
Breaking the ore	0.6540	
Loading into waggons and tramming	0.0501	
Engine-men, etc.	0.0362	
Timbering	0.0152	
Unwatering	0.0048	
Various	0.0078—	$0.781
Shops		0.024
Materials		0.132
Tools		0.009
Depreciation		0.031
Total per ton		$0.977

The cheaper working over the pillar-and-stall system is entirely on account of the cheaper breaking of the ore, the difference being about $0.26 per ton.

The system here described was started by Mr. C. Roepel, M.E., and subsequently carried on by the writer and Mr. P. E. Carr, M.E. It can be applied in all large masses and wide lodes, and is a safe and economical mode of getting all the ore.

The Cabezas del Pasto mine is one of the mines worked by the Bede Metal and Chemical Company, Limited, of Newcastle-on-Tyne.

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MINING NOTES.

[From Our Own Correspondents.]

Ontario.

Port Arthur District.

The mill of the Badger Silver Mining and Milling Co. resumed operations on Tuesday, 24th ult., and the mine is also being worked. There was some slight trouble that necessitated the closing down of the mine and mill for a few days, but we are pleased to say that we have been informed that the trouble has been amicably settled, and that the mine will be worked steadily by a large force of men.

A report reaches us that the owners of the iron locations near Kaministiquia intend opening up and developing their property. It is also said that the company is in communication with the C.P.R. company with the view of having a spur run from the main line to the location.

The British Columbia Iron Works Company are now making a large boiler for the Westminster Slate Company's quarry at Jervis Inlet. The boiler is five feet wide, and sixteen feet long.

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VOL. IV.

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THE GENERAL MINING ASSOCIATION OF THE PROVINCE OF QUEBEC — ORGANISED 1890

AN ORDINARY

QUARTERLY GENERAL MEETING

OF THE

GENERAL MINING ASSOCIATION

OF THE PROVINCE OF QUEBEC

WILL BE HELD IN

THE ASBESTOS CLUB HOUSE,

BLACK LAKE, QUE.,

ON TUESDAY, 14th JUNE, 1892,

COMMENCING AT HALF-PAST FIVE O'CLOCK IN THE AFTERNOON.

For the convenience of members and their friends attending this meeting a special car will be attached to the ordinary train (Quebec Central Railroad), leaving Sherbrooke, Que., at 8 a.m. on the morning of Tuesday 14th June. Black Lake members will join the party at 10.42 a.m. Train will arrive at Thetford Mines at 10.45 a.m., where some time will be spent in a visit to the Asbestos mines. Lunch will be served at half-past twelve o'clock (noon). Party will leave Thetford Mines at 1.30 p.m., returning to Black Lake by teams kindly furnished by the local Committee.

The ORDINARY QUARTERLY GENERAL MEETING for the reading and discussion of papers, etc., will be held in the

Asbestos Club House, Black Lake,

commencing at 5.30 p.m. Papers will be read by Mr. J. Burley Smith, M.E., Glen Almond, Que., and by Mr. L. A. Klein, M.E., Black Lake. At 7.30 members will be entertained to a dinner given in their honor by the Asbestos mine-owners and mine managers. Train will leave at 1 o'clock a.m. Wednesday, 14th inst., for Sherbrooke, where connection will be made for Montreal and points west. Tickets, $5.50 for the round trip (from Sherbrooke to Thetford and return) may be obtained from the undersigned, or from Mr. A. W. Stevenson, C.A., Treasurer, 17 St. John Street, Montreal.

GEORGE IRVINE, *President.* **B. T. A. BELL,** *Secretary.*

THE ASBESTOS CLUB,

Black Lake, Quebec.

The **General Mining Association of Quebec** will visit Thetford and Black Lake Asbestos Mines on Tuesday, the 14th instant, and the following is the proposed programme, viz. :—

A. Train (Quebec Central Ordinary) will leave Sherbrooke, Que., on Tuesday morning, the 14th of June, at 8 a.m. A special car will be attached for the use of members and their friends, and special rates will be given for return trip tickets to be obtained on board the car.

B. Train will reach Thetford Mines at 10.55 a.m., where the party will be received by the local committee.

C. After an inspection of the Mines, a cold lunch, provided by the Asbestos Club, will be served at 12.30 (noon).

D. The party will be driven in teams to Black Lake, leaving Thetford Mines at 1.30 p.m.

E. The Ordinary Quarterly General Meeting, for the reading of papers and the transaction of business, will be held in the Asbestos Club Room, commencing at 5.30 p.m. The following papers will be read :

"The Labour Question in its Relation to Canadian Mining."
By J. Burley Smith, M.E., Glen Almond, Que.

"Recent Practice in Economical Air Compressors."
By F. A. Halsey (Rand Drill Co.), Sherbrooke.

"The Present Status of the Asbestos Mining Industry in Canada."
By L. A. Klein, Supt. American Asbestos Co., Limited.

F. At 7.30 p.m. members and their freinds will be entertained at Supper by the asbestos mine owners.

Members going South can leave by the 1.20 a.m. Wednesday ; or going North, by the 3.00 a.m. same day.

Members of the Asbestos Club are especially invited to attend.

A. M. EVANS, M.E.,
Secretary-Treasurer.

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Goddard's Patent Grinder and Gold Saver.

Considerable interest has been evinced during the last few weeks, says the *Australian Mining Standard*, in the trials of a new gold-saving appliance, invented and patented by Mr. H. S. Goddard, engineer, of Uralia, New South Wales, who, for over two years has been engaged perfecting the invention. The machine is designed to save floured silver and gold which ordinarily are lost in tailings from batteries, and the several tests and trials, which have been of the most severe character, and have taken place at Langland's foundry, South Melbourne, resulted successfully. Goddard's patent differs from many appliances in its simplicity, efficiency and cheapness. It consists of a circular pan, the bottom and sides of which are lined with grooved hematite iron, in which works a muller, also with grooved bottom and sides, the grooves being placed at opposite angles to those in the pan. The weight of the muller is about 9 cwt., and it revolves in the lined pan at the rate of 150 revolutions per minute, its action on tailings running direct from the battery being to grind them fine as roller flour. The pan is fed from the centre of the muller at the rate of 9 cwt. per hour, and can be automatically fed from a battery, thereby saving an immense amount of labor and attention. After grinding is completed the material passes through the inner amalgamator charged with quicksilver, and the centrifugal action of the muller throws the fine sand over the edge of the pan into a ring well, also charged with quicksilver, so that it is impossible for gold to pass. The sand is kept agitated by several fingers revolving in the outer well, and is there discharged with the waste water at a spot in the outer casing of the machine. The wearing parts being of white hematite iron are very durable and arc easily renewed at any time. It is said that the machine now at work will receive and grind as much as can be delivered from a five-head battery, with gratings of 41 holes to the inch, thus effecting a material saving in cost of crushing and treating, leaving the residue finer than that from an ordinary battery. Tables and blankets are entirely dispensed with. The machine is further specially adapted for the treatment of fine gold, and should prove a desirable acquisition where flake or floured gotd is lost.

The *Australian Mining Standard* is informed that it has been successfully tried in the Hillgrove district, in New South Wales, where a quantity of tailings from the Eleanora gold mine, which gave by fire assay 5 dwts. 9 grains, were treated, and resulted in return of 4 dwts. 15 grains. Tailings from Alpine gold mine at Swamp Oak, which assayed by fire 23 dwts., were also put through the pan, giving a result of 21 dwts. A parcel of quartz from the Great Britain claim at the same place, which crushed about 6 ounces, gave 9 ounces 13 dwts. 1 grain. Two tons of tailings from Russell's Amalgamated Company, Victoria, which had been treated at the modern battery of that company, with 240-mesh gratings, gave a return of 2½ dwts. per ton. Another two tons from the same company gave 4 dwts. per ton, both from the new machine. Three trucks of tailings from Eaglehawk district (different claims) are being treated at present : the first lot of two tons gave 3 dwts. to the ton ; the others are being put through, and the amalgam promises encouraging results. A large number of other orders are on hand. The machine can be made in sizes suitable for 5, 10, 15 or 20 head of stamps ; it will feed itself ; is speedier than the usual chlorination process and does not lose a grain of quicksilver.

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Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of chap. 7, Revised Statutes of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of six months, which can be extended by renewal for another six months. Mines of ld and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. Up to ten areas the cost is 50 cts. per area, for every area in addition in same application 25 cents. Cost of renewal one half the original fees. Leases of any number of areas are granted for a term of 21 years at $2-00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and in smelted gold valued at $18.00 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 7½ cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

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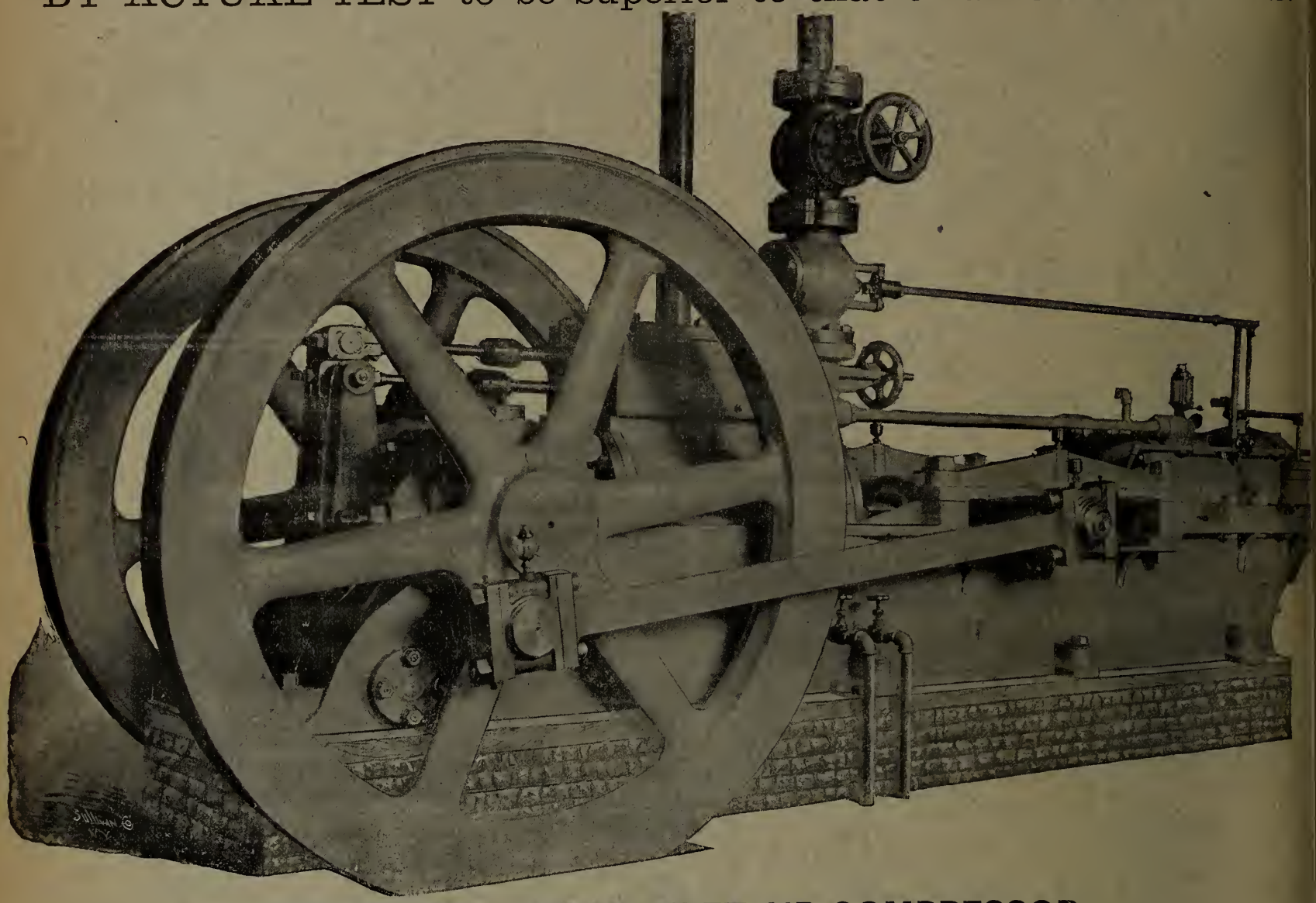
Our Coal Mining Machinery has this summer been thoroughly tested in several mines in Cape Breton, and has proved BY ACTUAL TEST to be superior to that of all other makers.



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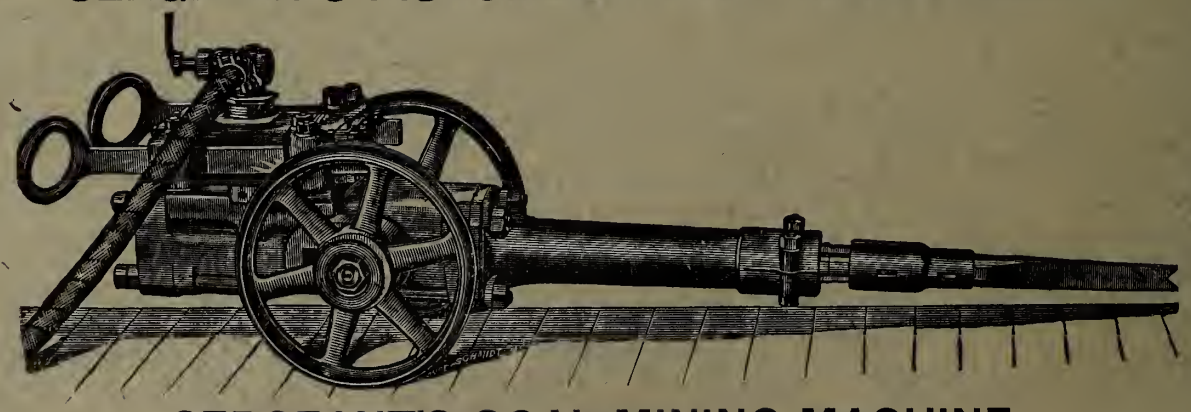

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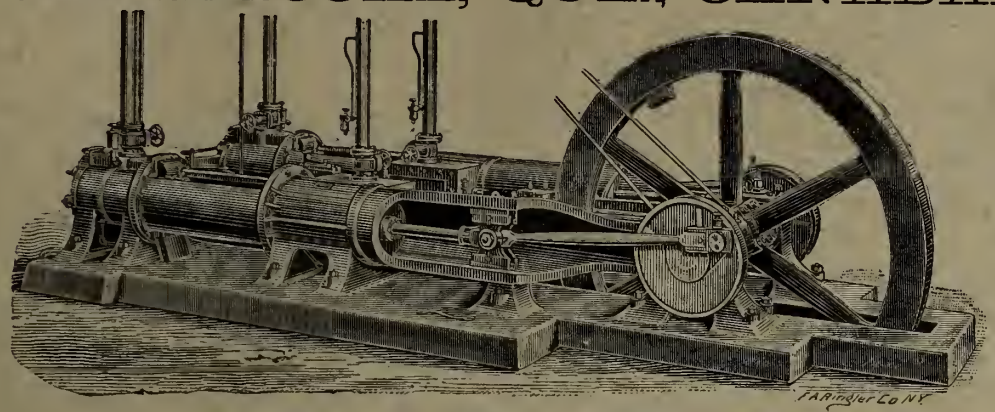

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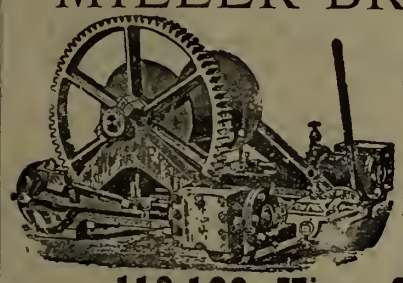

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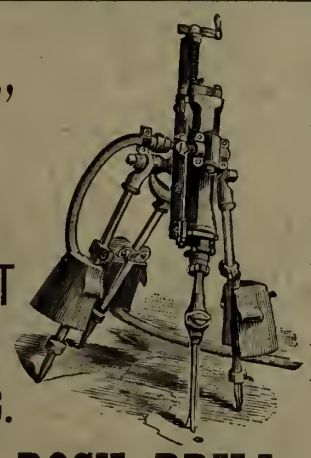

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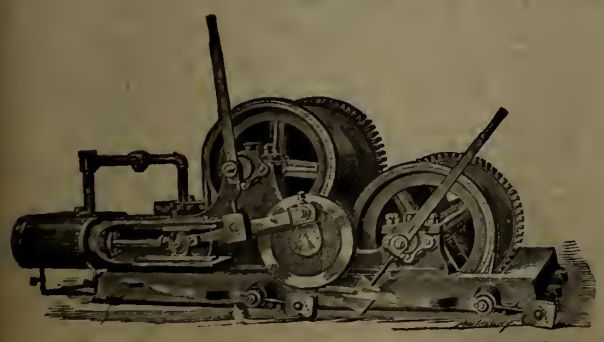

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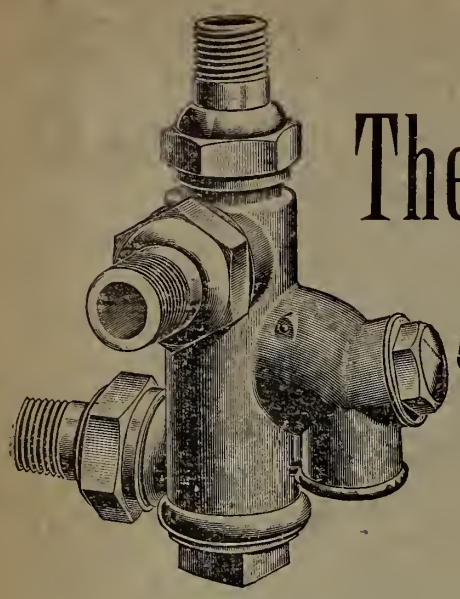

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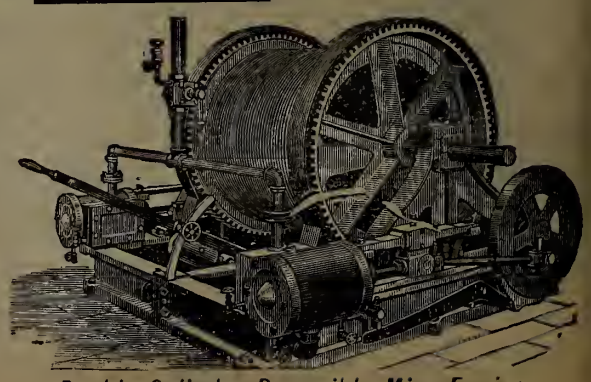

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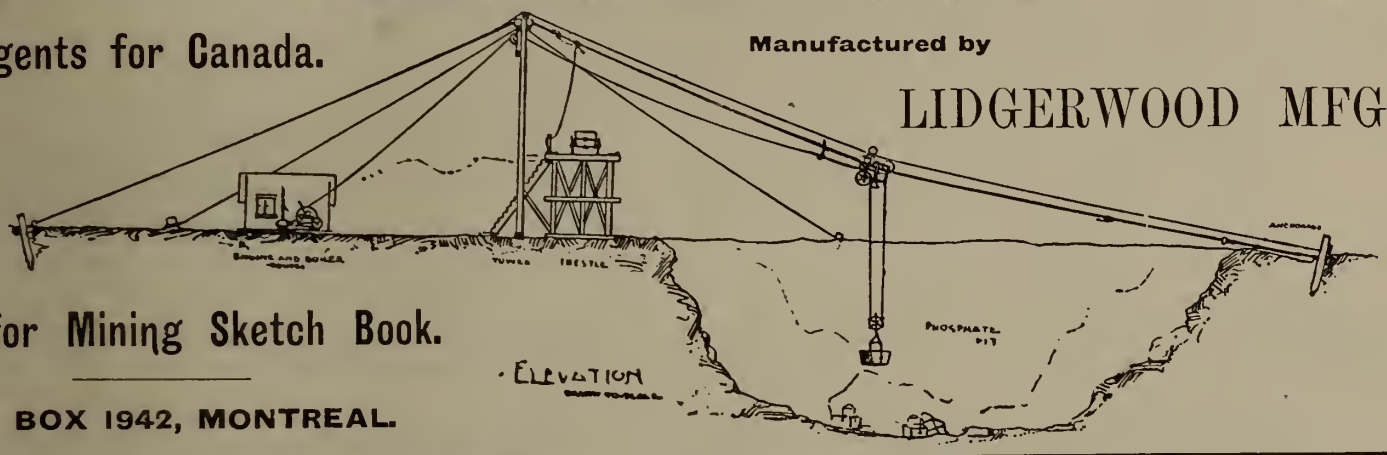

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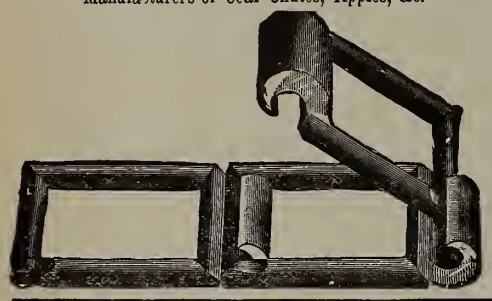

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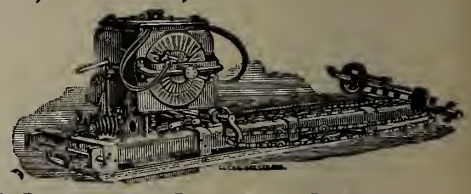

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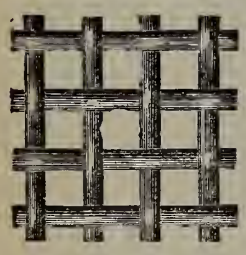

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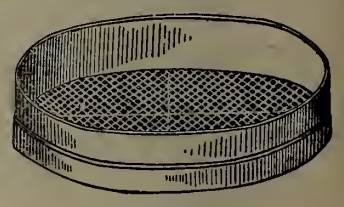

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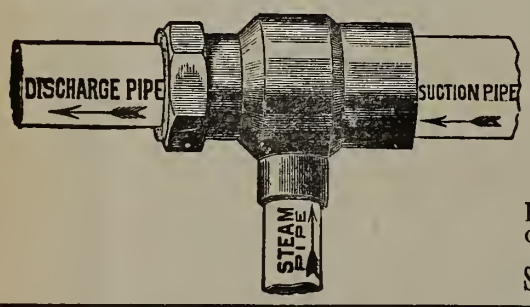

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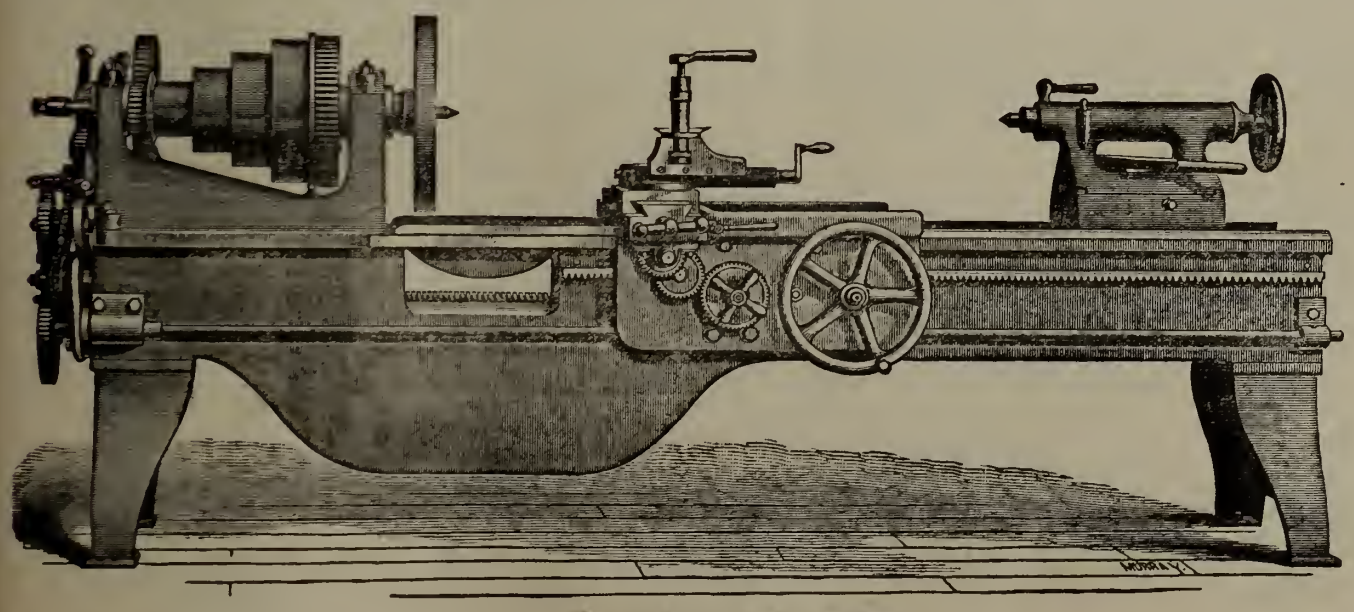

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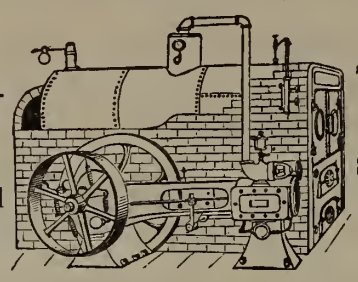

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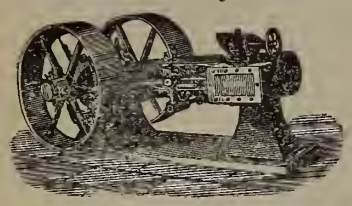

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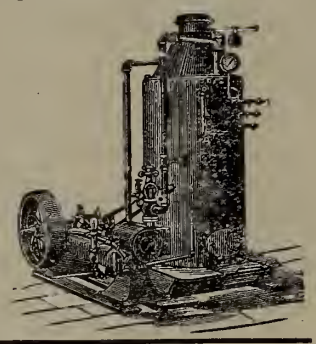

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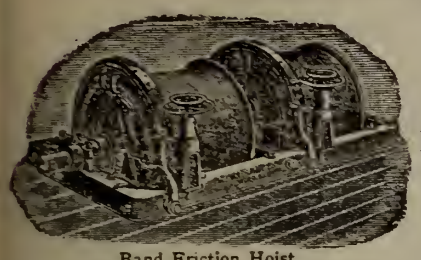

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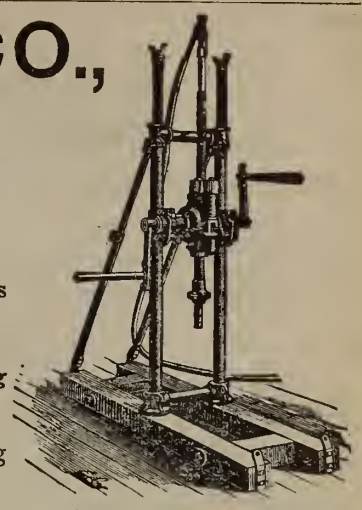

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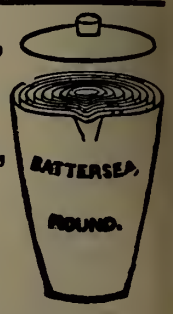

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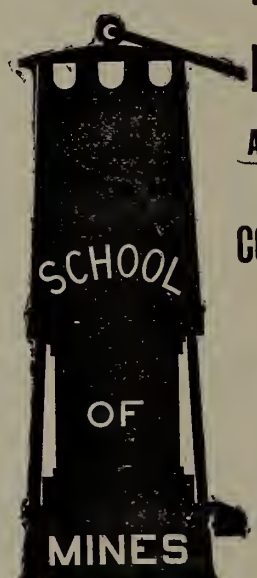

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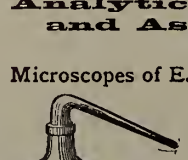

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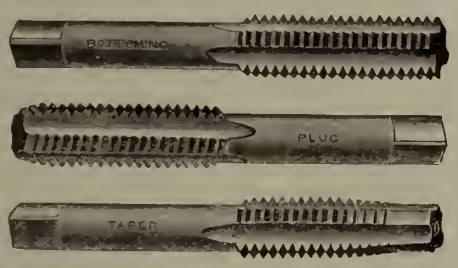

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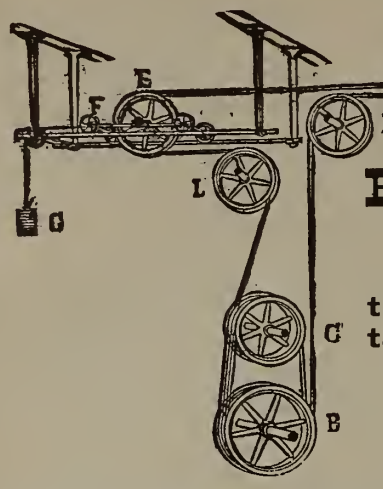

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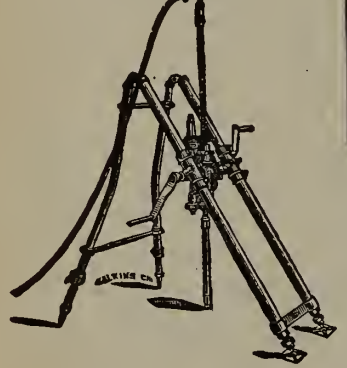

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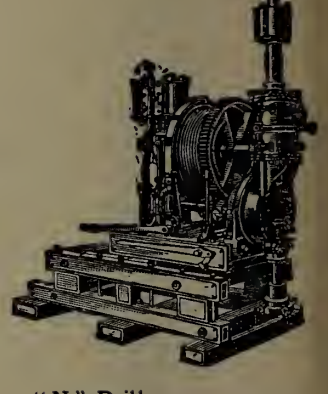

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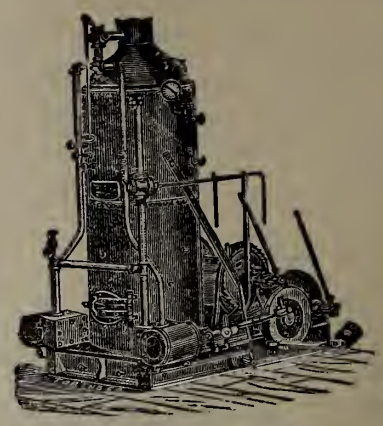

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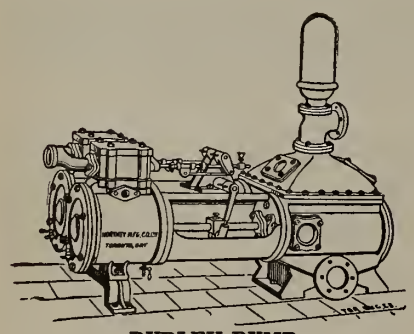

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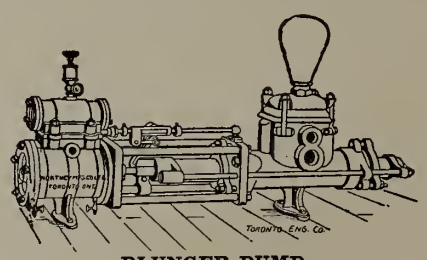

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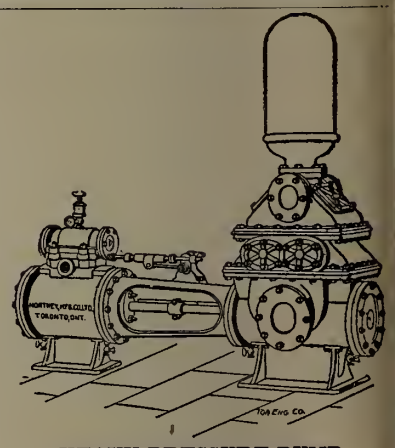

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CANADIAN MINING & MECHANICAL REVIEW

CONDUCTED BY - - - - - - B. T. A. BELL.

THE OFFICIAL ORGAN

—OF—

THE GOLD MINER'S ASSOCIATION OF NOVA SCOTIA,

THE UNITED MINING SOCIETY OF NOVA SCOTIA,

THE ASBESTOS CLUB, QUEBEC,

THE GENERAL MINING ASSOCIATION OF QUEBEC.

THE following Resolutions of Council indicate beyond a peradventure the status of THE REVIEW as the exponent of the Canadian Mineral Industries:—

The Gold Miners' Association of Nova Scotia.

"At the annual meeting of the Gold Miners' Association of Nova Scotia, held at Halifax on 6th March, 1889, THE CANADIAN MINING REVIEW was adopted the official organ of this Association.

(Signed), B. C. WILSON, *President.*
G. J. PARTINGTON, *Secretary.*

The United Mining Society of Nova Scotia.

"Moved by Mr. R. G. Leckie, seconded by Mr. C. A. Dimock, That the thanks of the Society be tendered to Mr. B. T. A. Bell for his kind offer placing the columns of THE REVIEW at the disposal of the Society; and that THE CANADIAN MINING REVIEW is hereby appointed the official organ of the Society."

(Signed), H. S. POOLE, *President,*
H. M. WYLDE, *Secretary.*

The Asbestos Club, (Quebec.)

"Resolved: That THE CANADIAN MINING REVIEW is, by authority of the Members and Council, hereby appointed the official organ of the Asbestos Club."

(Signed), D. A. BROWN, *President.*
A. M. EVANS, *Secretary.*

The General Mining Association of the Province of Quebec.

At a meeting of Council held at Montreal on Friday, 6th May, 1891, it was moved by Captain Adams, seconded by Mr. R. T. Hopper, and resolved: That THE CANADIAN MINING REVIEW be the official organ of the Association.

(Signed), GEORGE IRVINE, *President.*
B. T. A. BELL, *Secretary.*"

OFFICES:

Victoria Chambers, 140 Wellington Street,

OTTAWA.

Vol. XI. JULY, 1892. No. 7.

Direct Taxation in Quebec.

New brooms, we are told, sweep clean. The new besom at Quebec is no exception to the rule. Mr. DeBoucherville's Government has signalized its first year of power by inaugurating a policy of economy which, under ordinary circumstances, ought to restore the equilibrium between revenue and expenditure. But the circumstances of Quebec are not ordinary; they are, fortunately for the credit of Canada, without a parallel outside of the Province in any part of the Dominion. A more liberal application of the pruning knife is needed before any appreciable check can be put on the growth of the public debt. The maladministration, the reckless extravagance, the boodling and stealing of the past, have brought Quebec to the verge of bankruptcy. It is not enough to check extravagance, to discharge useless employés, to put an end to pilfering in public offices and compel the thieves to disgorge a portion of their plunder; more revenue must be had to meet the obligations of the Province and save Quebec from the disgraceful alternative of bankruptcy or repudiation. The Government has, as a last resort, introduced the thin edge of direct taxation. All other sources of revenue have been exhausted or are utilized to their fullest extent. That was the natural result of Mercier's policy "to spoil the Egyptian"—to take all he could from the pockets of the English speaking minority. Through their enterprise and intelligence, the English population practically control the capital and commerce of the Province. In their hands the mining resources of Quebec have been developed and made productive; through their energy and sagacity, industries giving employment to thousands of workingmen have been established throughout the Province. Mercier's policy was to cripple these industries by excessive taxation, thus, at one blow, inflicting serious injury on a class whose support he could never hope to gain, and providing money to reward his greedy followers. When Mercier was driven from office, the taxation of the English-speaking minority had reached its highest productive limit. In many cases it had passed the limit, closing up mines and mills and driving commercial companies from the country; there remained nothing more but to impose a general tax which would fall evenly upon the entire population of the Province. This obviously just policy has been commenced by the DeBoucherville Government, and, we may fairly assume, will be enforced while they remain in power. It speaks well for the honesty and courage of the Government that they have adopted a policy which cannot fail to be unpopular amongst the *habitants*. Hitherto the ignorant rural population of the Province has never realized the burden of indirect taxation that it has borne. It has never occurred to the mind of the simple *habitant* that the money poured so liberally into the treasury of the Province and so lavishly expended, had to come, in the end, from his pocket. No argument could convince him that he had any personal interest in seeing that the public revenue was judiciously and honestly expended. Now, however, when the tax-gatherer raps at the door he will begin to realize what it means to admit thieves and demagogues to the public treasury. The *habitant* has found it hard enough to pay the tithes exacted by the church and meet the demands of the fabrique; these exactions have kept him and his children in poverty and ignorance. How will he meet this new demand from the state? It will place him on a level with the Russian peasantry; but it will prove an undisguised blessing if it awakens him to a sense of his duty as a citizen of a free country. It will be a well spent tuition fee if it teaches him some of the rudimentary principles of political economy. The general election of last year showed what capacity for self-government our French Canadian citizens possess if they choose to cultivate it and exercise the duties, while enjoying the privileges of citizenship in a free country. If the Government can accomplish the abolition of the unnecessary Legislative Council, and retrench in other directions where savings can obviously be effected, the direct tax may, after a few years, be repealed, but in the meantime it will have the effect of opening the eyes of the people to the dangerous position to which demagogues have brought the Province, and may be the means of placing Quebec on a sounder financial basis than she has occupied since confederation.

The Coal Royalty Legislation.

In 1873 the Legislature of Nova Scotia enacted that the holders of coal leases issued subsequent to 1858 should be entitled to renewals upon the same terms, conditions and covenants as contained in the original lease. The royalty in the original leases issued up to 1866 was fixed at ten cents Nova Scotia currency per ton of screened coal; slack paid no royalty. The royalty was payable yearly. Those leases expired in 1866. In that year renewals were issued, fixing the royalty at 7½ cents per ton on both round and slack, payable quarterly. Some of these renewals, the Glace Bay Mining Company's among others, contained a clause that the Legislature might increase, diminish, or otherwise change the royalty. The question is: What was the intention of that clause? If its intention was that the Legislature might increase the rate of royalty beyond that fixed in the original leases, then it was a breach of legislative faith, seeing that in 1873 it had been enacted that the renewals were to be issued upon the same terms, hence at the same rate of royalty as in the original lease. But if the intention was that if the 7½ cents on run of mine proved to be less than the rate fixed in the original leases, the Legislature might increase it; or if found to be more than the original rate, the Legislature might diminish it, then it was no breach of legislative faith to enact said clause, and its insertion in the renewals issued in 1886 was lawful and right.

From 1885 until 1892 no change in the coal royalty was even suggested in the Legislature, and it is unquestionable that the new rate of 7½ cents had been found to be fully equal to the original rate. But previous to the last session of the legislature, the Government notified coal lessees that the rate of royalty would be raised, and when the house met it was raised 33½ per cent., that is, from 7½ to 10 cents per ton. Naturally enough, lessees objected, but were told to look at that clause in their renewals that the Legislature might increase the royalty as they might see fit. Well, on the face of it, and apart from the legislation of 1873 ensuring lessees renewals upon the same terms as in the original leases, it looked as if that clause left the unfortunate renewal holders at the mercy of a needy Government and of a legislative majority bound to carry out its behests.

After the Legislature adjourned, however, the official report of the debates in 1885 on the coal royalties was examined, and it was discovered that the intention of that clause was not that the Legislature might increase the rate of royalty so that it would be more than the original rate, but only that it would be equivalent to it.

To substantiate this statement I have made a number of extracts from the speeches of members of the Government and others when the coal royalty bill of 1885, changing the royalty to 7½ cents, was being discussed, which, perhaps, you may find room for in your paper, the organ of the new Nova Scotia Mining Society.

It will be noticed that the Hon. Commissioner of Mines stated that "the object of the Govern-

ment has been to get as nearly as possible an equivalent rate to the present rate of 9 and 7-10 cents per ton, a uniform rate that will yield an equivalent revenue to the present rate."

The Provincial Secretary also stated: "The real difficulty that he saw suggested was that the Government might be making a mistake, and that they had not the necessary information. He was going to suggest that the bill (which fixed the royalty at 7½ cents) might be passed with the provision that all leases issued should contain a stipulation that the royalties might be increased or diminished, which would leave the House free to make a change next year." "Free to make a change!" To what extent or for what intent? Clearly, according to what was said in the debates, only with the intent of obtaining a royalty equivalent to the old rate fixed in the original leases. For to increase the original rate would be a breach of faith. No wonder, then, that the Hon. Provincial Secretary's proposed clause passed unanimously, no one probably dreaming that it would ever be used as a pretext for any real increase of the royalty. Yet in 1892 it was held up as a clause agreed to in 1885 by both sides of the House which justified an increase of 33⅓ per cent., and a bill was passed imposing 10 cents per ton on all coal sold subsequent to 23rd February, 1892; and holders of leases running to 1906, wherein the royalty is fixed at 7½ cents per ton, are expected to pay the new rate. Should they be compelled to pay it? is an interesting question.

J. R. LITHGOW,
Sec.-Treas. Glace Bay Mining Co.

HALIFAX.

Extracts from the Official Reports of the Speeches of the Hon. Mr. Church and others, on a Bill to amend Chap. 7 of the Revised Statutes, Fifth Series, "Mines and Minerals," April 17, 1885.

HON. COMMISSIONER OF MINES—"As I understand the matter, Mr. Speaker, in the year 1826 His Majesty King George the Fourth granted to the Duke of York and Albany the mines and minerals of this province for the term of sixty years. This had the effect of preventing all other parties from leasing and working the mines of Nova Scotia. In 1857 the late Judge Johnston and Hon. A. G. Archibald, representing both political parties of the day, were sent to England to make arrangements with regard to this matter that might be more beneficial to the interests of the province. Their mission was successful, and as a result of their efforts, chapter 1 of the Acts of 1858 was passed, entitled, 'An Act for giving effect to the surrender to Her Majesty by the legal personal representatives of the late Duke of York and Albany, and by the General Mining Association and their trustees, of the mines in Nova Scotia, and to the lease of part of such mines to the said Association.' The effect of this legislation was that certain mining property in the Counties of Pictou and Cumberland, and on the Island of Cape Breton, were reserved to the representatievs above mentioned, now known as the "General Mining Association," and the remainder of the mines of the province were thrown open to general public competition. The General Mining Association received a lease which expires on the 25th August, 1886, and other parties coming in received leases, all of which expire on the 25th August, 1886. The royalty on coal in that chapter was fixed at the rate of sixpence, or ten cents old Nova Scotia currency, per ton, on what is known as round coal, that is, coal passed over a screen the bars of which are three-quarters of an inch apart. No royalty was charged on what is known as slack coal. As I understand at that time, slack coal was not of much value in this province, and hence the greater bulk of the sales was of round coal. The leases given to other parties were of the same character as that given to the General Mining Association, with a few exceptions, the royalty being payable on the same quality of coal and at the same rate; but the General Mining Association had the privilege of paying its royalties yearly in the month of March, whereas the others were liable to pay theirs quarterly.* Now the difficulties in the way of fixing upon a rate arises from various causes. During the last few years a great deal of slack coal has been sold, principally during the last five years. This increase in the sale of slack coal has arisen from various causes. One is that a great deal appears to be used in the province for various industries, and a good deal is put into the manufacture of coke. Hence it has become an article of value. Also within the past few years, the system has grown up in some mines, notably the Springhill mine in Cumberland, of selling what is known as "run of mine coal," that is, the coal as it arrives at the mouth of the pit without screening it at all. Of course, in selling coal in this way it is very difficult to get a proper return under the present system, which obliges the mine owners to pay royalty of $9\frac{7}{10}$ cents a ton, equal to 10 cents old currency on screened coal. As the owners of the Springhill mine sell so much run of mine coal they do not want to pay the same royalty that they might by law be obliged to pay, that is $9\frac{7}{10}$ cents per ton on their total sales.

"A difficulty in fixing the royalty also arises from the fact that the relative amounts of slack and round coal differ in Nova Scotia and Cape Breton. The percentage of slack coal is much greater in Nova Scotia proper than it is in the Island of Cape Breton. From careful statements made by officials in my department for a period of five years back, we find that the sales of round coal liable to pay royalty were, for Nova Scotia proper, 2,250,940 tons, and the sales of slack coal during the same period, 914,017 tons. In Cape Breton, during the same period the sale of round coal amounted to 2,317,704 tons, which shows nearly a hundred thousand tons more than Nova Scotia proper during the five years, while Cape Breton only sold during those five years 317,251 tons of slack coal, or nearly 600,000 tons less of slack than Nova Scotia proper sold. Now it will be very clearly seen that, on the coal sold during those five years, Cape Breton has paid more royalty than Nova Scotia proper, because she sold a much larger proportion of round coal, which alone paid royalty, than Nova Scotia proper. From 1880 to the end of 1884 inclusive, Cape Breton sold of round and slack a total of 2,634,755 tons, and paid a total royalty during the five years of $224,827.27. I have made a calculation which I vouch for as being correct, that this would give an average of $8\frac{5}{10}$ cents per ton royalty on the coal sold from the total output of Cape Breton during the five years. Nova Scotia sold during the same period 3,164,958 tons of round and slack coal, on which she paid a total royalty of $218,341.27, or $6\frac{9}{10}$ cents and a fraction, say 7 cents per ton, while Cape Breton paid 8½ cents per ton as I have stated.

* * * * * * * * *

"Now, sir, the object of the Government has been to get as nearly as possible an equivalent rate to the present rate of $9\frac{7}{10}$ cents per ton—a uniform rate that will yield an equivalent revenue to the present rate.

"Our rate was 10 cents a ton in former years, but by the Canada Currency Act, passed in 1868 or 1869, Nova Scotia currency was depreciated; so that $9\frac{7}{10}$ cents present currency became the equivalent of 10 cents old currency. Hence in the fourth series of the Revised Statutes, instead of having the rate of royalty named at 10 cents as in the previous series, it was put down at $9\frac{7}{10}$ cents. It might be argued that the province has been losing $\frac{3}{10}$ of a cent on every ton sold since that time, and the Government might have based their calculation on a royalty of 10 cents instead of $9\frac{7}{10}$. But this matter was very fully considered and we thought that as this rate of $9\frac{7}{10}$ per ton has obtained since the Currency Act came into operation, and that now a somewhat depressed condition of the coal trade exists, and as the outlook is not very promising at the present time, while the Government might fairly have adjusted the royalty on the basis of 10 cents, yet it would be said that we were placing burdens on the trade, tending to cripple its success, and therefore we based our calculations on the rate of $9\frac{7}{10}$ cents per ton.

"The third sub-section says:—

'Nothing in this Act shall compel lessees of coal mines in this Province to pay royalties other than on the terms prescribed in the leases now outstanding until said leases expire, but any such lessee may take advantage of the provisions of this Act from the date of its passage, if so disposed.'

"As I stated a few moments ago, the present outstanding leases lapse on the 25th of August, 1886. We provide by this section that the lessees of mines holding under leases now outstanding can take advantage of this Act, as soon as it becomes law, if they see fit; if they do not they will continue to pay royalty under the existing law until their leases expire; then, of course they will come under the provisions of this Act. There might have been no necessity for introducing this Act this session, were it not for the fact that there may be some new leases applied for between this date and next session, because, when the Revised Statutes, fifth series, become law, as they soon will, parties may come in for new leases. Another reason why it was deemed necessary to deal with the subject this session was, that under the provisions of the law, parties who wish to renew these outstanding leases are entitled to give six months' notice to the department of their intention. That would give the department ample time to have all these leases renewed after next April, were it not for this fact, that there may be questions of forfeiture raised, questions involving the title to these areas and there may be long and tedious investigations taking weeks to settle. Consequently it was not deemed wise to defer this legislation till next session, but it was thought better to bring it down this year. I may say, Mr. Speaker, that I hope in regard to any disputes that may arise, that the present holders may be able to renew their leases, and to carry on their works, but of course the Government will be obliged to carry out the law."

HON. MR. FIELDING—"I have not had much to do with the preparation of this Bill, which belongs to the department of my hon. colleague (Hon. Mr. Church), who has had the principal share in its preparation. I believe that if it is not the wisest solution, it is a solution of the question singularly happy to the mine managers. I received a note, and the hon. Attorney-General and a member of the other branches as well, from a mine manager of Cape Breton, stating that 7 cents on the ton of coal sold would be a fair rate. When we put on 7½ cents I do not think it is objectionable. I am sure the mine managers of Cape Breton do not think this Bill unfair. I am informed that the manager of the Cumberland mines has telegraphed that it is satisfactory to him. The Government say 7 cents would suit these gentlemen, but it would not give us so much royalty as we now get; we say we will put on 7½-cents, which will give us the same revenue as before. Now when we have put on only half a cent more than the miners name, I think it must be satisfactory. There are three interests to consider: First, the Province, we get the same revenue; second, the interest of the mainland collieries, and we have showed that they are satisfied; at least the Cumberland collieries; from conversations I have had with Mr. Leckie, I am warranted in saying that; third, the Cape Breton collieries; the Associations say 7 cents, but the agent has said that 7½ cents is not objectionable to them. It seems to me, therefore, that the Bill protects the interests of all concerned; the Province gets the same revenue and the coal trade gets fair play."

HON. MR. CHURCH—"I wish to correct the hon. member for Inverness on one point. Seven and a half cents per ton, I said, would give us a little more royalty than we received last year on the same output. I consider it fair to judge on the basis of an average of 25 per cent. of stock. Now there is no other convenient figure than 7½ cents unless we go down to 7 cents. A million tons would give, say, 750,000 tons of round and 250,000 tons of slack. Multiply 750,000 by $9\frac{7}{10}$ and you have $72,750 as the royalty that we would get from a million tons under the present system. Then take a million tons at 7½ cents and you have a product of $75,000, the gain being simply $2,250 on a million tons. That is very little. Now the object the department had was simply to get a uniform rate that would give the same revenue we are now receiving."

HON. MR. LONGLEY—"All were united in the opinion that there should be no tax on coal, but in our present financial circumstances it was not a policy which this Government could adopt to make any substantial reduction."

HON. MR. FIELDING said, "That if the effect of this amendment was going to reduce the revenue, then his hon. friend should move not only to reduce the tax on culm coal, but to raise it on other coal half a cent or a cent a ton. The hon. Commissioner of Works and Mines, in moving the second reading of the Bill, had stated that it would give about the same revenue as the old rate. If there was any doubt, he presumed the hon. Commissioner had given himself the benefit of the doubt. He would strongly urge that no amendment be made which would reduce the amount the Province would receive. He thought it was generally admitted in the House that, however much we would like to see the royalty done away with, we could not now do it."

HON. MR. CHURCH—"He (Commissioner of Works and Mines) thought this Bill must either be passed in its present form, or else withdrawn and another introduced next year. The outstanding leases did not expire until 25th August, 1886; but there might be applications for new leases before that date, and the Government wanted to know what rate to put in new leases."

HON. MR. FIELDING said: "He did not think it reasonable to ask that slack coal should be exempted after the Government had based a figure on all coal. The Bill in the main was satisfactory to mine owners. The real difficulty that he saw suggested was that the Government might be making a mistake and that they had not the necessary information. He was going to suggest that the Bill might be passed with the provision that all leases issued should contain a stipulation that the royalties might be increased or diminished, which would leave the House free to make a change next year; unless some such provision was made parties taking leases might complain."

MR. BELL said that with the consent of the hon. member for Cumberland and on the understanding that such a clause would be added to the Bill, he would withdraw his amendment.

HON. MR. CHURCH said that all the information that the Government or the department had was included in the returns. The Government had no power to enforce any of the returns as regards the cutting of the coal, and he believed that it was no part of the duty of the inspector to pry into the accuracy of such returns. That was the difficulty in regard to an *ad valorem* tax. The only object the department had was to fix a rate that would be fair all around, and would give an equal amount of revenue to that now received from this source.

The photogravure illustrations of the recent excursion meeting of the General Mining Association of Quebec, published in this number, are from the kodak of Mr. J. Lainson Wills, F.C.S.

* Not correct. Ours were payable yearly. J. R. L.

EN PASSANT.

The Dominion Government has acceded to the universal desire of the mining community of Nova Scotia, as advocated in these columns, and has instructed the engravers to prepare the new geological map of that Province on the scale of one mile to the inch, instead of four, as originally proposed. The engravers report that good progress is being made with the work.

During the recent fighting on the Kashmir frontier, when the British troops defeated the rebellious Hunzas, the natives used bullets of garnets encased with lead. Tommy Atkins could doubtless throw some light upon a rather novel and painful form of mining for these curiosities.

No mining country has a monopoly of capital mis-spent in mining ventures. A recent issue of the Australian Government *Gazette* notifies no less than 255 gold mining and crushing companies that if they are not reported as operative within three months they will be swept into oblivion. "Most of them," the *Week* says, "are gold mining companies, and some with high-sounding and encouraging names; but even their fine names couldn't keep them going. The 'Gilded Rose' appears to be just what it says, with the gilt all gone. The 'Heart's Content' may now be read, 'The Heart is Content'—has had enough of it.'

A Swedish officer named Ekeland has invented a coking oven which is continuous in its operations, and in which not only coal, but wood, and more especially peat, may be reduced to a good quality of charcoal or coke. Up to this time there has been no successful method for utilizing peat to any great extent, but it is believed that much will be accomplished by this new oven. The inventor claims that a ton of coke or charcoal produced from peat will yield as much heat as a ton of ordinary coke, notwithstanding that in the former there must be a large proportion of ash. In the matter of cost it is stated that the new material need not cost more than 10 francs a ton in Sweden, while the English coal imported costs 25 francs in Sweden. A company has been formed at Stockholm with a capital of $750,000 to push the invention, which has been patented in the United States, Great Britain and Germany.

Some official statistics have recently been published with regard to the production of gold in French, British and Dutch Guiana. Though the discovery of gold in French Guiana took place in 1856, yet it only began to be seriously worked in 1864. Since the latter date 35,817 kilogrammes have been exported. The production in 1891 was 1,502½ kilogrammes, and was less than the average of the last sixteen years. The tax on entering the city of Cayenne is 10 francs per kilogramme, and a duty of 8 per cent. is paid on exportation. The number of men employed on the placer mines of French Guiana s 1,800. Of the nine quartz mining concessions granted up to date two are being worked, but great difficulties stand in their way. In 1891 101,297 ounces of gold were produced, compared with 62,616 ounces in 1890; 28,282 ounces in 1889; 74,570 ounces in 1888; 11,906 ounces in 1887, and 6,518 ounces in 1886. The production in Dutch Guiana was 814 in 1890, an increase on 1889, but not so great as in 1887.

Apropos of the Nova Scotia coal royalty. The question having been raised as to whether, in order to test the legality of the Government's action, it would be advisable to refuse payment, a consultation was held lately at which Messrs. Henry, Drysdale and Borden, eminent Halifax lawyers, reported upon the position the coal companies would thus assume under recent statutes. The concensus of opinion was that the Government could adopt one of three courses: *First*—They could sue for the royalties in our Supreme Court. *Secondly*—They could issue a warrant of distress under section 146 of the "Mines and Minerals Act, 1892," under which the sheriff could levy upon and sell such portion of the personal property of the company as would be sufficient to pay such royalties. *Thirdly*—They could take proceedings, under the provisions of the lease, to forfeit the lease for breach of the conditions therein contained. The second course is the one that would probably be adopted. Any company refusing to pay would, however, run the risk that the third course might be adopted, the result of which might be that the lease would be forfeited. In this view it seems inadvisable for the companies to take the extreme step of refusing payment of the royalties. If it is desired to test the question whether the statutes mentioned apply to existing leases, the Government would probably enter into a special case to be argued before the Supreme Court. A memorial to the Governor-General-in-Council is now being prepared on behalf of the companies, asking for the disallowance of this legislation.

The Quebec Government having repealed the Mercier Act of 1890, has just passed in its place an Act which will, we think, give general satisfaction to the mining community of the Province. It respects vested rights. The price of Crown lands containing minerals has been increased to a reasonable figure, which, while increasing this source of revenue to the Government, should not in any way retard the investment of capital. If the lands on which it is proposed to operate mines are situated within twelve miles of a railway the price of sale, in future, is to be $10 an acre for superior minerals (including gold, silver, copper, iron, nickel, graphite, phosphates and mica), and $4 an acre for inferior minerals; and if more than twelve miles from a railway, $5 for superior and $2 for inferior, or minerals other than those enumerated. An important clause, from the public point of view, gives the Commissioner of Crown Lands the right to offer at auction any mining location of special value. Care is also taken to prevent the locking up of valuable areas in speculators' hands by authorising the cancellation of sales when bona fide attempts are not made to work the deposits. Provision is also made for mining under lease where such method is preferred. The Hon. Mr. Flynn may be congratulated on a measure whose provisions are in the main equitable alike to the Government, the operator, and the investor.

Some pertinent remarks on the subject of the redemption of capital invested in collieries were made by Mr. H. D. Hoskold at the last meeting of the Federated Institute of Mining Engineers. He claimed that a company had no moral or equitable right when profit accrued to absorb it all as dividend profits, and provide no redemption fund. The plan sometimes adopted by accountants and financial agents of merely writing off a capricious sum per year for depreciation in place of redemption, was certainly a fictitious mode of dealing with the question, because, instead of being made an accumulation fund in reserve, as it should be, the sum so written off actually passed into the pockets of the partners or shareholders of a colliery company as part and parcel of the common dividend. A company engaging in the exploitation of a colliery with lease extending over an agreed term, is, or should be, placed in exactly the same position as any private party investing a certain fixed sum of money to buy a fixed income at a given rate per cent. upon the capital for a definite period. This question of redemption was of the greatest importance, and was undoubtedly as onerous upon the lessee of a colliery as it was upon the lessor, because, in the former case the surface estate was rendered more valuable during the period an annual income was derived from the exploitation of coal mines below it.

Readers will remember that in our March issue there was reviewed at some length the advance sheets of a very commendable work on the phosphates of Florida and Canada, from the pen of Mr. C. C. Hoyer-Millar. The book, nicely printed and creditably gotten up, is now out, and readers who may not have received a copy should address the Scientific Publishing Company of New York, who are the selling agents on this side.

Since the publication of our exposé of C. M. Dobson, we have received a number of letters from readers in Chicago, Western Ontario, and the Maritime Provinces, adducing evidence of further shady dealings by this notoriously unscrupulous person. Our warning, while it prematurely shut off Dobson's would be connections in Nova Scotia and New Brunswick, did not, it seems, prevent him walking away with cash and specimens to the value of $500, the property of unsuspecting gold miners, who had been misled by the *Critic's* pernicious eulogy of the imposter. By the way, it is now some four months since the *Critic*, smarting under rebuke, blusteringly promised its readers a full and complete defence of its protégé. Surely the *Critic* has not been caught bluffing?

In a paper read recently before the Federated Institution of Engineers some interesting facts relating to the progress of gold mining in New Zealand were brought out. The writer, Mr. George J. Binns, said the first results in Auckland were disappointing; instead of the nice alluvial deposits which had characterised the South Island, but little ground of this nature was found. This peculiarity still remained, the deposits yielding generally 54 to 75 per cent. of gold, and 46 to 25 per cent. of silver. In spite of these early drawbacks the reefs had turned out fabulously rich, in some cases yielding at the rate of 600 ounces to the ton. The yield of gold for 1890 was £125,760; the total quantity of gold entered for export to the 31st December, 1890, was 1,639,357 ounces; value, £6,122,173. Taking 33 mines in the west coast gold fields, which had crushed stone, £96,575 had been paid as dividends and £310,692 worth of gold had been produced. In the North Island alluvial mining was not carried on to any appreciable extent. Estimating the average earnings of miners was an exceedingly difficult matter, but taking the period ending 31st March, 1890, the figures came out as £51 2s. 7d. per man per annum, as against £59 16s. 6d. for the previous year.

Mr. W. S. Gresley, in a recent paper before the Western Pennsylvania Mining Institute, claims the following circumstances as being suited to longwall working in preference to any pillar-and-room method:—

a. Where all the coal is sought to be mined out.
b. Where the highest selling price is on lump coal.
c. Generally where the seam is under 6 feet thick.
d. Where dirt bands or much refuse is contained in or has to be mined with the coal.
e. Where economy in timber is a desideratum.
f. Where concentration of work is desirable.
g. In gassy seams where the fresh air current should sweep the working faces.
h. Where shots or shot-firing are a nuisance.
i. Where black-damp and bad air are troublesome.
j. Where division of labor is desirable.
k. Where the best work is desired to be gotten from under-cutting machines.
l. Where the top and side weights are most felt.
m. In thin seams or heavy pitches.
n. Where a fairly steady sale obtains.
o. Where it is desirable to let down the surface as regularly and as evenly as possible.
p. For very thin flat seams.
q. Where plenty of skilled diggers can be had.
r. Where rapid opening up of workings for a large output is a point.

Upon good, systematic under-cutting, run in as far under as the seam is high, and a continuous length of it completed before any of the coal is thrown down or allowed to fall down, greatly depends the success or failure of longwall. Some walls require to be under-cut some hours before they are ready to come down; others will hardly stand being under-cut the full distance; others again need no under-cutting to speak of. Stated generally, the deeper the under-cut the better the product. The proper management of the roof or "top-weight" in working successful longwalls is one of the chief features of the system, the great point being to so regulate or control the pressure on the face that it shall be neither more nor less than enough to bring down or greatly assist the miners in bringing down the "web" when it is ready to fall, and be loaded up.

Mr. Wm. Duncan, fifth bituminous mine inspector, contributes a paper before the same Institute, in which he gives interesting facts in favor of the advantages of slopes over shafts. Among these he enumerates: Smaller cost of opening; less height to lift the coal and water; but one pair of engines required instead of two, while the liability to wreckage is less; coal may be gotten out much sooner, thus enabling one to realize on his investment much more promptly; material may be more readily taken into the mine, and finally by allowing water to fill the portions of the mine where the work is completed, there is just so much less water to pump out, and less space to drain and ventilate. In the shaft system no water can be allowed to accumulate until every ton of coal is mined. To prove these points, Mr. Duncan takes a suppositious coal field, 5000′ square, having a slope of 5′ to the hundred, making a total of 250′ slope. This is about the average in the coke region. A railroad is located at the outcrop, and another immediately over the dip boundary line. To work this by shaft would require two 250′ feet shafts, a hoisting shaft costing $100 per foot, or $25,000, and an air shaft costing $70 per foot, or $17,500. The yield of this suppositious coal field is estimated at 5,740,000 tons, which in the shaft method would needs be lifted 250′, together with about three times this weight of water, while in the slope method the total lift would not exceed 150′, and some of the water, which is left in the worked out portions, need not be elevated at all. As to capital invested, Mr. Duncan estimates the cost of slope openings at not more than $1,000, as compared with $42,500, the estimated cost of the shafts, while two sets of engines are required in the shaft method to one set with the slope method, the point being made that as much power is required to control the descending load in the shaft system as the ascending load in the slope, while there is less liability to wreckage in the latter case, and rails, etc., can be more conveniently carried than when they have to be placed vertically on the car in the shaft. Another very important advantage which the slope system possesses is the rapidity with which the field may be opened. Coal may be had in a month's time, and by the end of six months coal for 200 ovens may be obtained, while by the shaft method six months would be required before any coal at all could be secured.

In describing a new safety cage at the meeting of the Federated Institute Mr. Whitelaw stated that from 1857 to 1868 the average annual loss of life from over-winding alone was about 24. During that period 300,000 men on an average had to descend and ascend pits daily in the performance of their duties. In 1890 the number employed underground increased to nearly 500,000, and at that rate of increase the number of men now employed underground in Great Britain will be about 600,000. Assuming these have to be lowered and raised at the pits say 250 times a year, it would be equal to 300,000,000 separate times, and that from pits ranging in depth from 40 to 800 yards. Considering the risks attendant upon descending and ascending pit shafts, Mr. Whitelaw attributes the comparatively small number of accidents that have occurred to the application of suitable machinery and to skilful attendance. The safety cage under consideration is another contribution to the efforts to still further reduce that number. The safety appliance consists of an arrangement of levers, springs and grippers, and of rods instead of chains; but more particularly of the teeth of the grippers on the ends of the levers. The grippers or catches are brought into play, if the rope breaks or the cage becomes disengaged by the detaching apparatus, in cases of overwinding, by the strong blade springs fixed to a centre bar. The provision made for the adjustment of this spring consists of a piece of leather or India rubber inserted under it and acting as a cushion. When thus adjusted it is not liable to derangement. Mr. Whitelaw added that two cages of this construction were in daily use for eight years at a colliery under his charge.

The phosphate produced by the General Phosphate Corporation has been seized at the instance of local creditors—among others the Ottawa Powder Co., I. Bernardin and J. Lainson Wills. This looks like the beginning of the end.

Among the archives of the Mining Society of Nova Scotia, we came across, the other day, the following satirical reference to some methods of company promoting not unknown to some of our readers:—

PROSPECTUS.

Frog Lake Mining, Birch Broom Making, and Blueberry Crushing Company.

Capital, $1,000,000.

The property contains 1,000 acres. There are one hundred leads of gold from $\frac{1}{16}$ to an inch in thickness, all of which are gold-bearing, more or less.

To give an idea of the large dividends which may be expected, the proprietors refer to the high prices which blueberries and birch brooms command in the market. Since the purchase of this property there have been raised the material for eight birch brooms, and sufficient blueberries to manufacture a quart of port wine.

The present proprietors have no hesitation in recommending this property to the public as a profitable investment, believing it will prove the BEST MINING and blueberry and broom brush growing property in the province.

Present Proprietors.

Sampson Carter, Esq.	Adam Phool, Esq.
Gabriel Hall, Esq.	Jos. Southdown, Esq.
George Lambert, Esq.	Samuel Crawley, Esq.
Shadrach P. Ross, Esq.	Zachariah Goose, Esq.
Samuel Lees, Esq.	Richard Bloke, Esq.
Richard Blue, Esq.	Ba. A. Lamb, Esq.

The capital, to be subscribed and paid up, 1,000,000 shares at ½ cent a share, $5,000. To be applied as follows:

For the purchase of property	$4,000
Erection of wine press, birch broom factory, and mining machinery	750
Working Capital	250
	$5,000

The *Stock Lists* will be found at the office of Adam Goodman, and at the residence of Fisher Lambrick, in Mouse Street, also at the "Stag" Hotel, Preston.

The present proprietors having taken a large amount of the stock, a limited number of the shares only will be placed on the market.

We clip the following gem from the Australian *Mining Standard:*

He was a simple countryman, but as persistent as he was unsophisticated, and when he once formed an idea or a resolution it stuck to him like wax. He got an impression, how it does not matter, that some dark rubbly stuff on his selection was coal, and with all sorts of visions of wealth before his eyes, he sailed down to a friend in the

Mines Department and worried him for days and days to get an expert opinion upon his chunks of rock. The official thought to put him off and wear him down by temporising, but the bucolic was not to be put off, and at last the Mines man got the stuff reported on. The verdict was unfavorable, and so exasperated was the Government official at the trouble he had been put to for nothing that his annoyance smothered the sympathy he should have naturally felt for the country friend whose fond hopes were blasted. He readied himself up for a final visit from the owner of the samples, and in announcing the result of the tests to which they had been subjected delivered himself somewhat as follows: "You believe that at the last day the world will be consumed with fire?" "Yes," answered the amazed and expectant countryman. "Well, then," continued the official, "you just go home and tell your friends that you can make yourself all right against the last day, for the stuff on your property will be about the last thing on God's earth to burn."

The Coal Fields of Cape Breton Island.

By Robert Robertson, Jun.*

The coal field of Sydney, occupying an area of about two hundred square miles, is the most extensive, and has been asserted to be the most valuable in the Province of Nova Scotia. It extends from Mira Bay on the east to Cape Dauphin on the west, a distance of 31 miles, and is bounded inland by the Millstone Grit formation, and dipping towards the N.E. under the sea, in the direction of Newfoundland, thus forming one extremity of a great coal region, the main body of which lies under the Atlantic Ocean. The total thickness of measures is stated as being not under 7,000 feet, and a fine natural section can be seen on the north side of Sydney Harbour, three miles long, and measuring 1,860 feet in thickness. This section contains no less than 34 seams of coal, of which, however, only a few are workable.

The Sydney mines district of the Sydney coal fields occupies an area of about ten square miles, the principal seam in the district being known as the Six-foot, or Sydney Main seam.

The first operations in this Main seam were commenced in 1785 by Governor Lieut.-Col. Desbarres, on Government account, when the Island was erected into a separate Government. From 1785 to 1826 the mines were leased to six individuals or companies, and were three times in the hands of the Government, and on the 1st of January, 1827, the mines came into the possession of the present owners.

The General Mining Association was organised in 1825 by Messrs. Rundell, Bridge & Rundell, the late well known firm of jewellers and goldsmiths, who obtained a transfer of the lease of all the mines and minerals in Nova Scotia which had been granted by George IV. to his brother, the Duke of York. The lease of the Sydney mines, which were not included in the Duke's lease, expiring on the 31st December, the mines were offered to the G.M.A. for one year on the terms then in force, pending other arrangements to obtain a long lease on more favorable terms. The amount of royalty at that time was 4s 3d per ton.

In 1828 an agreement was made with the Provincial Government by which the G.M.A. obtained a lease, terminable in 1886, of the Sydney Mines, the terms of which were that the G.M.A. upon payment of a fixed rent of £3,000 sterling a year should be allowed to sell 20,000 chaldrons (Newcastle measure) in Nova Scotia and Cape Breton, at 1s 7d sterling per Newcastle chaldron, upon all coal sold over that quantity.

These rents and royalties were paid up to the year 1845, when the British Government consented to allow the Association to sell 26,000 instead of 20,000 chaldrons at the same fixed rent. This last agreement continued in force until December 31st, 1857, when the G.M.A. surrendered their claim to all the mines and minerals, except within certain well defined limits, reserving an area equal to 34 square miles in Cape Breton, and 12 square miles in Nova Scotia proper.

The agreement made with the Government of Nova Scotia in 1858 fixed the amount of royalty at $4\frac{6}{10}$ pence per ton on all large coal up to 250,000 tons per annum, and $3\frac{6}{10}$ pence per ton on all coal sold over 250,000 tons.

The first steps taken to open out the works were inaugurated in 1830, when a shaft 200 feet deep was sunk, which continued to supply the trade until 1834, when another shaft, 320 feet, was sunk, 400 yards further to the dip. This shaft continued in operation until 1854, when it was lost by a heavy influx of water, which overpowered the pumping engine. In the meantime, a new shaft had been sunk and equipped in anticipation of such a disaster, and was brought into operation. This shaft is 400 feet in depth, and now forms the upcast shaft for the present workings. This shaft is known as the Queen Pit.

In 1865 a lease five square miles in extent, of submarine area, was obtained, and for the purpose of working this area the sinking of the present shafts was commenced in 1868. These shafts are situated near the shore, at the north-west entrance to Sydney Harbour. They are placed 22 yards apart, one is 13 and the other 11 feet diameter, and are 670 feet deep, and known by the name of Princess Pit. In the course of sinking, heavy feeders of water were met with at a depth of 300 feet, which were successfully tubbed off with cast-iron tubbing, both shafts being lined to a depth of 300 feet. The larger shaft is used for winding, and the smaller one contains the pumps, and is used for lowering and raising the men. The winding engine is of 160 H.P. nominal, and has two high pressure horizontal cylinders, 36 inches diameter, with five foot stroke, crank shaft 15 inches diameter, carrying a round rope drum 20 feet in diameter. These engines are capable of raising 1,000 tons of coal per day of ten hours.

The engine raises two tubs at a time, standing end to end in the cage. Each tub carries 14 cwt. of coal. Four slides are fitted for each cage, but the cages run on the wall slides only with shoes, the inside of the cages being fitted with bevelled irons, which run on the slides. The winding ropes are of steel, $4\frac{1}{4}$ inches in circumference. A very simple and effective means is employed to break the fall of the cage on the bottom, which consists of a bed of spruce boughs, and forms an excellent cushion, on which the cage alights, and so effectually breaks the fall of the cage, that after having been renewed, the cage rests without the slightest shock.

Two hauling engines are placed near the bottom of the shaft, the steam being taken from the surface in 10 inch pipes.

The North engine has two 18 inch cylinders, 3 foot stroke, geared 1 to 3, with 4 foot drums for main and tail rope. These engines haul out of two deeps, one branching off the level 100 yards from the shaft, and is one mile long, with a branch 1,500 yards. The other deep branches off the level at 750 yards from the shaft, and is 1,500 yards to the bottom of deep. The empty trips descend by gravity, the tail ropes being used only on the level. The dip varies from 1 in 10 to 1 in 14, and trips of 26 to 30 tubs are hauled at a time.

The South engine has two 16 inch cylinders, 2 feet 9 inch stroke, geared 1 to 3, with 4 foot and 5 foot drums for main and tail rope respectively. These engines also haul out of two deeps, one branching off the level at 160 yards from shaft, and is 1,200 yards in length, with a branch in course of formation. The empty trips descend this deep by gravity, the dip varying from 1 in 22 towards the top to 1 in 12 towards the bottom. Trips of 32 to 38 tubs are hauled. The inside deep branches off at 560 yards from the bottom, and is one mile long to the landing. The dip in this deep is undulating and variable, being from 1 in 14 to 1 in 52. The tail rope is used to take the empty trips inbye, and 40 to 45 tubs are hauled on each trip.

The main ropes are $2\frac{3}{4}$ inches in circumference, and the tail rope $2\frac{1}{2}$ inches, of best plough steel, imported from England.

The hauling of the coal from the faces to the engine roads is done by horses, from 45 to 50 being usually employed. The stables are large and well ventilated, and afford accommodation for 60 horses.

The system adopted is a modification of the stoop-and-room method, but none of the pillars are being taken out, the workings being all under the Atlantic Ocean. The main levels and deeps are driven in pairs, 8 feet wide and 10 yards apart. The rooms are $16\frac{1}{2}$ feet wide, and are carried parallel to the levels. At intervals of 70 to 80 yards single deeps and headways are set off as they advance, and are again broken off as the deeps and headways win them. Midway between these deeps and headways, cross-cuts are driven between the rooms, almost invariably downhill from the higher to the lower room. These single deeps, headways, and cross-cuts are driven 9 feet wide, and the pillars are 12 yards thick on the square. The rooms are broken off 12 feet wide and put through at the same width.

The ventilation of the workings is effected by means of a Guibal fan placed at the top of the Queen Pit. The fan is 30 feet diameter by 10 feet wide, and at 40 revolutions per minute circulates 80,000 cubic feet of air, with a water gauge of $1\frac{3}{8}$ inches.

For the purpose of unwatering the mines, a large Cornish engine is in operation. The cylinder is 62 inches diameter with a stroke of 9 feet, and the water is raised by two bucket lifts, each 20 inches diameter. Eight hours' pumping is usually sufficient to keep down the water. There is also a large pumping engine at the bottom of the Queen Pit, which forces the water to the surface in one column. This engine is direct acting, with large flywheels, cylinder 24 inches diameter and 4 foot stroke, plungers 10 inches diameter.

An engine of the same type with 36 inch cylinder is being erected at the bottom of the Princess Pit to force the water to the surface in one lift to supersede the Cornish engine.

The pit bank, screens, and engine houses are lighted by electricity, and electric signals are in operation under ground on the engine plancs.

Steam is supplied at Princess Pit by six egg-end boilers 35 feet by $5\frac{1}{2}$ feet, and 3 multitubular boilers; and 4 egg-end boilers, same size, are at Queen Pit.

The colliery is also fully equipped with large workshops, including waggon and tub-shops, smithies, steam hammer, pattern, and carpenters' shops, foundry, sawmill, fitting shops, with large turning lathe, planing, drilling, screwing machine, and screw cutting lathe; also boiler and locomotive shops and sheds.

The coal is shipped at North Sydney, four miles distant from the pit, and three locomotives are required to carry the coal during the shipping season. The greater part of the coal raised is sent up the St. Lawrence to Montreal, Quebec, and several other places; and while the navigation is open everything is pushed as much as possible to execute contracts and get away the greatest amount of coal in the shortest possible time, in order to overtake the great rush of trade, which usually extends from May to November. Large quantities of coal are landed during the winter months. It is nothing unusual to have 40,000 to 50,000 tons landed in this way.

The severity of the winters and the drift ice in spring are great hindrances to the coal trade in Cape Breton. If the winter sets in early, the harbour may be frozen over in December, and remain so until April. Then, if it breaks up and gets cleared out, it opens the way for the drift ice to come in, which often blocks the harbour in May, and even in June.

The miners, as a rule, are civil and respectful, and well to do, some of them owning horses and waggons, cattle, houses and land, boats and fishing gear, and can take their stand alongside the best of our British miners.

DISCUSSION.

The PRESIDENT said this was an interesting practical paper. There were some particulars as to working coal under the sea which might be of use to some of the members. Before long there would be a great deal wrought under the sea in Fife and the Lothians, and he believed in Ayrshire too.

Mr. DURIE asked why they were superseding the Cornish engine at the pit-head.

The PRESIDENT asked if the author would be good enough to say: first, the thickness of the seam worked under the sea; secondly, the percentage of coal taken out; and thirdly, the depth of the coal from the bottom of the sea.

Mr. JOHNSTON said it might be interesting to know the character of the strata there.

The discussion was adjourned.

* Transactions Mining Institute of Scotland.

Nova Scotia Coal Royalty—An Interesting Correspondence Between Premier Fielding and Mr. J. R. Lithgow, Sec-Treas. Glace Bay Mining Company.

Halifax, 6th May, 1892.

Hon. W. S. Fielding,
Provincial Secretary.

Dear Sir,—It occurs to me to make one more appeal to you, and through you to the Government of Nova Scotia, to do the Glace Bay Mining Co., Ltd., an act of justice.

If your legal adviser will show that we are not justly and legally entitled to what I am about to ask of you, then we must be content. Our case is briefly as follows:

1. Prior to 1866 we held, and still hold, three coal leases which expired in 1886, but by the legislation of 1873 were renewable for three periods of twenty years each, up to 1946, upon the terms, conditions and covenants of the original leases.

2. There was nothing in our original leases touching a change in the royalty. It was fixed at 6d. per ton with slack free.

3. In 1873 and up to at least 1883, we were entitled to renewals up to 1946, with the royalty fixed at the rate named.

4. The foregoing being admitted to be correct, without a breach of provincial faith we were entitled to such renewals in 1886.

Allow me to illustrate my contention. Suppose I owned a large wheat farm and gave you a lease of it in 1865 for 21 years, to terminate in August, 1886, at a rental of $7\frac{1}{2}$ cents per bushel of wheat raised and sold by you. Then, suppose that in 1873, I assured you by a written document that you, by giving me six months' notice prior to August, 1886, would become entitled to renewals of your lease for twenty, forty or sixty years from 1886, on the terms of your original lease. What would you think of me if, two or three years prior to 1886, I wrote you that you could have renewals, but they must contain a provision that the rental may be raised as I may see fit? Would you regard me as an honest man? Would you not call my second proposal, repudiation, or something like that?

But again, suppose, as you could not help yourself you accept a renewal with that provision inserted, thinking probably that the rent would never be raised, the owner being a just man, and in 1892 you were suddenly notified by me that the rent up to 1906 would be ten cents per bushel instead of $7\frac{1}{2}$ cents; and up to 1926 it would be not over $12\frac{1}{2}$ cents; and after 1926, well, I would not say what it might be: how would you feel towards me?

For a dozen years at least, you believed you were sure of renewals up to 1946 at $7\frac{1}{2}$ cents per bushel, and in 1892 you find you cannot get them from me for the periods I had promised even at $33\frac{1}{3}$ per cent. advance on the original rental: could you regard me as an honourable man? Before you could do so you would say, "Mr. Lithgow, give me the renewals you assured me in 1873 I would be entitled to in 1886."

Now I beg to say to you, with all due respect, give us the renewals we were assured by the legislation of 1873 we were entitled to on giving six months' notice prior to August, 1886, on the terms, conditions and covenants of our original leases; else, I must appeal to the people to do us justice.

To enable you to settle with us in accordance with existing legislation, we will accept leases running until 1946 at ten cents royalty on all coal sold, save the 60,000 tons we sold in January last.

Holders of leases issued since 1866 are not in the position we are to claim renewals at the old rate of royalty, for the leases since '66 had the "revise and alter" clause in them.

Hoping to hear from you,

I remain yours respectfully,
J. R. Lithgow,
Treas. Glace Bay Mining Co., Ltd.

HALIFAX, May 18th, 1892.

DEAR SIR,—I beg to acknowledge receipt of your letter of 6th inst., which reached me on my return to town after a few days' absence.

I regret that I am unable to agree with you in your views respecting the coal royalties.

Pressing engagements would render it impossible for me to discuss the subject at any length with you at present. A brief statement, however, will be a sufficient answer to your letter.

1. It is true, as you state, that your original leases referred to contain "nothing touching a change in the royalty."

2. But it it also true, although you do not state it, that those original leases contained nothing touching a renewal of the leases; consequently, so far as any contract between your company and the Government was concerned, your rights ceased and expired in 1886, and if you had then received no leases at all you would have had no cause of complaint.

3. The mining laws had, however, been amended from time to time, not as a matter of special contract with your company, but in the general interests of the Province. You seem to think that you have a right to pick out of twenty years of legislation such parts as you like and claim the benefit of them, while ignoring all the rest. It should not be necessary for me to argue against such a view. If, having no rights whatever under your leases after 1886, you desired to claim rights under the general law, you had to deal, not with selected parts of the statutes, but with the whole law. You were not bound to continue to work your mines. You were at liberty to withdraw from the business on the termination of your contract. But you preferred to apply for renewed leases under the law as it then stood, including a provision respecting the right of the Government to increase the royalty. You did so apply, the leases were granted, and you went on your way rejoicing in privileges which the Legislature had generously given you, but which it might have withheld altogether without affording you a shadow of cause for complaint or breach of contract. That you should have applied for these privileges, accepted them and enjoyed the advantages of them for nearly six years and now assail the Legislature which gave them to you seems to me to be most unfair.

If in any "appeal to the people" which you desire to make you will include this statement of the case I shall be content to await their judgment. I have the fullest confidence that the course pursued by the.Government in this matter has been in the public interests and that ample justice has been done to every private interest affected by the legislation.

Yours faithfuliy,

J. R. LITHGOW, ESQ., W. S. FIELDING.
Treasurer Glace Bay Mining Co., Ld.

HALIFAX, 19th May, 1892.

Hon. W. S. Fielding.

DEAR SIR,—I beg to acknowledge your valued favor of the 18th and to reply thereto.

1. It is true that our leases, in common with all other leases issued between 1858 and 1866, contain nothing touching renewals, but you are certainly wrong when you say "consequently, as far as any contract between your company and the Government is concerned your rights ceased and expired in 1886, and if you had then received no leases at all you would have had no cause of complaint.' You know that by the legislation of 1866 we became entitled to renewals in 1886, and again by the legislation of 1873 we were entitled to renewals in 1886 "upon the terms, conditions and covenants of our original leases," upon giving six months' notice prior to August, 1886, of our intention to renew our original leases. That notice we gave. How then can you affirm that had we received no leases (renewals you mean) in 1886 we would have had no cause of complaint? Do you undertake to say the Government could legally have refused to give us renewals? Do you hold that it was optional with the Government to renew or to refuse to renew our original leases? You know that the Government was bound by the law of Nova Scotia to issue the renewals we applied for in accordance with the law. "No cause of complaint had we not got any renewals in 1886"! You surely cannot hold to that opinion. The contract embodied in our original leases issued by the Government between 1858 and 1866 was legally renewable for three periods of twenty years each, from August, 1886, upon the terms, conditions and covenants of the original leases, and we had by law the right to demand such renewals up to six months prior to the expiration of the original leases in August, 1886.

2. I have never claimed that the mining laws were amended as a matter of special contract with our company, nor have I claimed the right to pick out of twenty years of legislation such parts as I like and claim the benefit of them, while ignoring all the rest. Thence it was not necessary for you to argue against that view. We had legal rights in renewals of our original leases, and in December, 1885, applied for renewals as we had a legal right to do, and as all holders of leases issued since 1858 had the same right to do, and the Government was bound by law to give them on the same terms, etc., of the original lease and as prescribed by any Act of the legislature up to the time of issuing the renewals.

3. The revision and alteration of the royalty made in 1885 was no infringement of the rights guaranteed to the holders of leases by previous legislation, inasmuch as it did not increase the royalty. Even the clause that the royalty "might be increased or diminished as the Legislature might see fit," you must remember, or if you do not can ascertain by reference to the debates in the House on the change in royalty, was suggested by yourself, not with a view to increasing the provincial income from the coal royalty, but in order that if 7½ cents on all coal were found to yield more revenue than the original $9\frac{7}{10}$ cents on screened, with slack free, it might be diminished, and if found to yield less it might be increased by, say, ½ a cent per ton. It was distinctly stated by the Hon. Commissioner of Mines in those debates (in 1885) that all the Government wished was a royalty equivalent to the old rate. The intention of that clause, which was to be inserted in all leases (not in renewals) issued after the passing of the Act authorizing it, was clearly stated by yourself, the Attorney-General and the Commissioner of Mines, and you will admit was not to justify any increase beyond the old rate, which in bulk will not be increased without a legislative breach of faith, seeing that for many years previously holders of leases were assured that they could obtain their renewals on the terms of their original leases—hence not exceeding the original rate of royalty—up to August 1946.

Yes, we applied for renewals, accepted them and enjoyed the advantages of them since 1886, and I respectfully submit that without the glaring breach of legislative faith recently enacted we should have continued to enjoy them up to August, 1946.

In any appeal to the people I may make your sentiments shall be published as you desire.

Yours very respectfully,
J. R. LITHGOW.
Treasurer.

HALIFAX, May 19th, 1892.

J. R. Lithgow, Esq.,
Treasurer Glace Bay Mining Co.

DEAR SIR,—I beg to acknowledge receipt of your letter of this date in relation to coal royalties.

I think there is danger of some confusion of the words "Government" and "Legislature" in dealing with this question. The Government had no power except such as the Legislature conferred upon it. The Government is merely the instrument for carrying out the directions of the Legislature. It is with the Legislature, rather than with the government, that you have to deal.

In my letter of 18th inst. I pointed out that your original leases contained nothing touching a renewal, and I added, "Consequently, so far as any contract between your company and the Government was concerned, your rights ceased and expired in 1886, and if you had then received no leases at all you would have had no case of complaint." You dispute this and you ask if I will undertake to say the Government could legally have refused to give the renewals. Let us assume that, in view of the legislation that had in the meantime been passed, the Government were bound to give you renewals. But I must point out most distinctly that *the Legislature was under no obligation whatever to you to pass such Acts.* If it had not passed them, and if you had been left to stand upon your lease, you would have had no just cause of complaint. You would have received all that the Government had contracted to give you. Whatever privileges you have received since 1886 you have received, not because you had any contract right to them, but because the Legislature in its wisdom and generosity was pleased to give you such privileges. But if it had given you nothing there would have been no breach of faith.

You say: "We had legal rights to renewals of our lease and, in December 1885 applied for renewals, as we had a legal right to do, and as all holders of leases issued since 1858 had the same right to do, and the Government was bound by law to give them on the terms of the original lease and as prescribed by any Act of the Legislature up to the time of issuing renewals." Well, in this passage you admit the whole case. You had no rights whatever except such as were prescribed by the law *as it existed at "the time of issuing the renewals."* A part of that law read as follows:—

"All leases of coal mines issued after the passing of this Act shall contain a provision that the royalties may be increased, diminished, or otherwise changed by the Legislature."

It was under that law that you applied for leases. The leases were granted to you in 1886 in conformity with that law and accepted by you without any question. The leases show on their face the right of the Government to increase the royalty. Is it not preposterous then for you to come forward and deny the Government's right which is so clearly set forth on the very document which you hold?

You say that clause was inserted in the Act of 1885 at my own suggestion. That is perfectly true. Every outstanding lease which contained any right of renewal contained also a specific declaration of the right of the Government to revise and alter the royalty in and after 1886. Nobody was rash enough to question that right. It was desirable that every lease to be issued in or after 1886 should contain on its face an emphatic recognition of the right; hence the insertion of the clause which was unanimously approved by the House. You say that at the time it was not intended to increase the royalty. That is quite true. I stated, and every other member of the Government who discussed the question stated, that we did not desire at that time to obtain a larger royalty than the rate then existing, namely, nine and seven-tenths of a cent per ton on round.

The language of the Act of 1885 is too plain to admit of a moment's doubt. It must be clear to everybody that although the Legislature did not at the moment wish to increase the rate of royalty it did wish to declare most emphatically the right to increase it at any future time. The Government's views in this respect met with the unanimous approval of the House of Assembly, and I am quite satisfied that they have the approval of the public at large.

If there has been any breach of faith in this matter it has not been on the part of the Legislature or Government. They have kept faith. The only attempted breach is on the part of those who, after obtaining through the favor of the Legislature privileges to which they had no contract right, now appear to wish to repudiate their own agreements and assail the Legislature which dealt so liberally with them.

Yours faithfully,
W. S. FIELDING

HALIFAX, 20th May, 1892.

Hon. W. S. Fielding.

DEAR SIR,—Your kind favor of the 19th was read on the following evening, and as only good can come out of mutual desire to know the truth of the subject we are discussing, I beg again to trouble you. You say after reading my letter of the 19th that the Government were bound by legal enactment to renew the leases we held. That the Legislature of 1866 and 1873 were under no obligation to pass the Act entitling lessees to renewals, any more than to authorize the issue of original leases, no one has ever disputed, The Government could only give what the Legislature authorized, and hence if the Legislature in 1873 had not enacted that the holders of coal leases issued since 1858 and expiring in 1886 were entitled on giving six months' notice prior to August, 1886, to obtain three renewals of twenty years each up to August, 1946, we could not have claimed them. And again, if the Legislature had not in the same section enacted that the said renewals were to be issued upon the terms, conditions and covenants of the original leases, we could not claim that the insertion of a clause in the renewals that the royalty might be increased was a breach of Legislative faith. Nor could we claim that the increase of one-third, that is from 7½ to 10 cents per ton, is a most flagrant breach of the legislation of 1873, under which we were entitled to leases to terminate in August, 1946, at the old rate of royalty, namely, 9·7 cents per ton on coal except slack, a rate revised and altered in the Legislature of 1885, but not raised.

You do not seem to appreciate the fact that a Legislature cannot without repudiation, or a breach of faith, enact in 1892 that leases of coal areas must pay one-third more rent than the same Legislature had in 1873 enacted the lessees should pay up to 1946. A Legislature may by enactment put lessees in a better position than they previousiy were, but they cannot subsequently, without a breach of faith, make their position worse during the periods of the leases issued to them. A lessor of a property has the right to lease it for a certain number of years at a certain rental, say from 1862 to 1886 at $7,500 a year. He has also the right to assure the lessee, in say 1873 that he can have renewals of his lease at the same rental, for three periods of 20 years each from 1886 on giving six months' notice, but he cannot without a breach of faith, subsequently either refuse his promised renewals, or give them with a clause inserted that the rent may be increased. Above all, he cannot during the first renewal period give notice to the lessee that the rent shall be at once increased from $7,500 to $10,000 a year until 1906: after which and until 1926 it will not exceed $12,500 a year. I say, he cannot; well, I mean he cannot honorably, whatever he may be able to do legally. You will have no difficulty in seeing from this illustration what a gross breach of faith the Legislature at their last session committed, in raising our rental from 7½ to 10 cents per ton, seeing they had in 1873 guaranteed us that until 1946 it should not exceed 7½ cents, which you will admit is the full equivalent of the original rate. The fact that the Legislature in 1885 authorized the insertion of a clause in leases issued thereafter, to the effect that the royalty might be raised, I fully admit, but I contend that said clause could not be inserted in the renewals referred to in the legislation of 1873 without a breach of faith. It could be inserted in new leases, but not in renewals which were to be issued upon the terms, conditions and covenants of the original leases, hence, with no increase of royalty.

Again, no one knows better then you do that the said clause was passed by the Legislature simply because it was uncertain whether or not the altered rate of royalty—7½ cents on all coal, round and slack—would be the equivalent of 9.7 cents on round with free slack. Any increase over the old rate, the debates clearly show, especially the statement of yourself and the Hon. C. E. Church, was distinctly repudiated. That clause was enacted so that if 7½ cents yielded more revenue than the old rate, it might be diminished hy a quarter of a cent; and if it yielded less than the 9.7 cents, it might be increased sufficiently to make it the equivalent of the original royalty. In was not designed to legalize any increase of the original rate per ton, either then or at any future time. You cannot show from the debates which led to the enactment of the clause in question, that the Legislature did wish to declare most emphaticaily the right to increase it at any future time. The Government, or such members of it as spoke during the debates, never hinted that the object of the clause was to declare the right to increase the 7½ cents beyond what would make it equivalent to the old rate. Admitting that every outstanding lease which contained any right of renewal, contained also a specific declaration of the right of the Government to raise and alter the royalty in and after

1886, you should bear in mind that there were in 1873 outstanding leases issued subsequent to 1858 which contained no right of renewal and no declaration of the right of the Government to revise or alter the royalty in and after 1886, and that the holders of such leases—the Glace Bay Mining Co. among others—became by the Act of 1873 entitled to renewals on the terms, etc, of the original lease, hence, at the old original rate of royalty, or as amended in 1885, but without any clause as to revising, altering, diminishing or increasing the royalty, and that hence the holders of such leases did not receive in 1886 such renewals as they were legally entitled to, seeing they contained a clause under which the Government have claimed the right to exact until 1906 one third more royalty than the lessees were formerly entitled to pay. Again, the leases which were the same originally as the Glace Bay Mining Co's issued prior to 1866, but which were renewed in 1860, and whose renewals contain the provision that the royalty might be revised or altered in and after 1886, were, I hold, equally with leases not then renewed, entitled under the legislation of 1873 to renewals until 1946, on the terms, conditions and covenants contained in the original leases; hence, with no provision that the royalty might be revised or altered, increased or diminished. That the royalty might be diminished, or changed, or altered, as long as it was not increased, I freely admit; just as a landlord may freely lower a tenant's rent, or make it payable quarterly instead of monthly, without any breach of faith; but he cannot increase it during the term of his lease. No more may the Legislature increase the royalty on those who in 1873 held leases renewable till 1946, at the rate of royalty named in their original leases.

It is true that the Glace Bay Mining Co. and other lessees who applied for renewals at least six months prior to August, 1886, obtained them with the royalty specified at 7½ cents per ton, and did not object at the time to the clause that the royalty might be increased or diminished, supposing it was legally inserted, and that anyhow the royalty would not be increased; but, surely, the real binding contract is not a document issued from the mines office, but the Acts of the Legislature, construed in accordance with consistency and good faith; for the written lease can only be viewed as binding so far as it has the sanction of the legislative enactments upon which its validity depends.

You speak of privileges we have received since 1886; perphaps you will kindly specify them. I know of no privileges we have received since 1886, from either the Government or Legislature. Our original leases were obtained nearly thirty years ago. The legislation entitling us to renewals up to 1946, at the old rate of royalty, payable yearly, was passed in 1873. All that we have to thank the Government and Legislature of 1892, or since 1886, for, is a breach of public faith heretofore unheard of in Nova Scotia, and most injuriously affecting the value of our coal properties.

When the time comes for the Commissioner of Mines to collect 10 cents per ton royalty on run of mine coal instead of the 7½ cents fairly due, it may be tested whether or not the recent Mines' Act can be enforced. If it can, then another legislature may cancel our leases, or make the royalty 50 cents per ton, notwithstanding the legislation of 1873.

Yours respectfully,
J. R. LITHGOW,
Treasurer.

HALIFAX, May 25th, 1892.

J. R. Lithgow, Esq.,
Treasurer Glace Bay Mining Co.

DEAR SIR,—I have neither time nor inclination for continuing a discussion with you which can only amount to a reiteration on both sides of what has already been said. Every material point in your letter of 23rd inst. has been dealt with in my letters already addressed to you. As you did not receive or seek any leases under the law of 1873, nearly every word you say concerning that law—and that means the greater part of your letters—is beside the question. You applied for and obtained leases under the law as it stood in 1886, which law distinctly recognized the right of the Legislature to increase the royalty.

If the closing paragraph of your letter is meant to indicate that your company intend to attempt to repudiate its contract and set the law at defiance, I need say nothing more than that the Government are not unaware of the power with which the Legislature has clothed them in regard to such a case.

Yours faithfully,
W. S. FIELDING.

The Nova Scotia Coal Royalty—An Eminent Legal Opinion on the Issue.

Previously to 1866 the General Mining Association held certain leases from Her Majesty of coal areas in Nova Scotia.

By the Statute 29 Victoria (Nova Scotia), Chapter 9, Section 1, it was enacted as follows:

"Lessees of coal mines in this Province, their executors, administrators and assigns, holding leases from the Crown, or from the Chief Commissioner of Mines, made since the first day of January, A.D. 1858, or hereafter to be made, shall, upon giving notice in writing to the Chief Commissioner of Mines at least six months previous to the expiration of such leases respectively of their intention to renew such leases respectively for a further period of twenty years from the expiration thereof, be entitled to a renewal thereof for such extended term upon the same terms, conditions and covenants, as contained in the original lease, and in like manner upon giving a like notice before the expiration of such renewed term to a second renewal and extension of term of twenty years from and after the expiration of such renewal term, and in like manner upon giving like notice before the expiration of such second renewal term to a third renewal and extension of twenty years, from and after the expiration of such second renewed term, provided that at the time of giving such notice, and the expiration of such terms respectively, the said lessees, their executors, administrators and assigns, are and shall continue to be *bona fide* working the areas comprised within their respective leases and complying with the terms, covenants and stipulations in their respective leases contained, within the true intent and meaning of Section 104 of the Act hereby amended, and provided that in no case shall such renewal or renewals extend, or be construed to extend, to a period beyond sixty years from the 25th day of August, A.D. 1886, and provided also that the Legislature shall be at liberty to revise and alter the royalty imposed under such lease in or after the year 1886."

In the fourth revision of the Statutes of Nova Scotia (R.S. 4th Series, Cap. 9, Sec. 102), which came into effect in the year 1873, and in the fifth revision (R.S. 5th Series, Cap. 7, Sec. 105), which came into effect in the year 1885, the provision as to increasing the royalties was altogether omitted from this Section.

In 1885 the Statute 48 Victoria (Nova Scotia) Chap. 4, was passed. Section 4 of that Act is as follows:

"All leases of coal mines issued after the passing of this Act shall contain a provision that the royalties may be increased, diminished, or otherwise changed by the Legislature."

In 1886 the leases granted to the Association expired, and all necessary conditions having been performed, renewals were granted.

My opinion is asked:

1. As to whether the word "leases" in the Statute 48 Victoria, Cap. 4, Sec. 4, includes these renewals.

2. As to the meaning and effect of the following clause in the form of renewal above mentioned: "Provided that the Legislature shall be at liberty to increase, diminish, or otherwise change the royalty imposed by these presents, or renewals thereof, as they may think fit."

1. I am of opinion that the word "leases" does not include these renewals, but only includes original leases granted after the passing of the Act. The provision is expressly made applicable only to leases issued after its passage. If the Legislature had intended to include leases issued before, but renewed after the passage of the Act, it would undoubtedly have expressed that meaning more plainly, e.g. by using the words "a renewed" after the word "issued" in this Section.

2. I am of opinion that the words of this clause or proviso have, strictly speaking, no legal effect whatever. The Legislature has power to increase, diminish, or otherwise change the royalty, and this provision cannot in any way affect that power.

If the lease is to be construed as if the word "lessor" or the words "Commissioner of Public Works and Mines" were substituted for the word "Legislature," then a serious question does arise.

That question is this: Can the royalty be increased without the consent of the lessee at any time during the continuance of the term granted by the renewal, or can the power be exercised only on the occasion of a further renewal of the lease? In other words, is it intended to give the lessor power to increase, diminish or otherwise change the royalty on every day in the year during the sixty years, or only at the expiration of each period of twenty years, and upon the renewal of the lease.

I am of opinion that this provision must be read in connection with the provisions for renewal, and that if the words "Lessor" or "Commissioner" were substituted for "Legislature" the Commissioner could only increase the royalty on the occasion of a renewal.

This construction gives a reasonable effect and meaning to the lease. It gives the lessee a term of twenty years at a certain rent and the option of refusing to renew if the royalty be increased oppressively. It gives effect to every word of the proviso. It gives effect to the words "These presents" because the royalty thereby granted may require to be increased when the next renewal is granted. The word "renewals" is also required in order that the royalty imposed by any renewal may also be increased upon the occasion of a subsequent renewal.

Any other construction would bind the lessee to a contract of the most unreasonable and uncertain nature, and would place in the hands of the lessor extraordinary and unreasonable powers of oppression. A lease of that character would be absolutely useless and valueles as an inducement to invest or continue capital in mining enterprises. Such a construction will not be placed upon the provision unless the words absoutely require it. And I think they do not so require.

HALIFAX. (Signed), R. L. BORDEN.

The Cost of Mining Labour in the United States.

A recent Foreign Office report gives some interesting details regarding the conditions and cost of mining labour in America. We make the following extracts:—

Illinois.—Coalminers proper are always piece-workers, and control in greater or less degree their own time. Being paid for the number of tons they mine and deliver—not for the hours they work—the amount of coal sent up is the measure of their earnings, and the proprietor keeps record, and is interested in this rather than in the hours of labour. Fortunate in the character of the mineral, his own skill, or other circumstances, the miner may do more than a nominal day's work in less than a day's time and quit work, or, if unfortunate, he may work overtime, or he may work when the mine is not running and get coal ready to hoist. Therefore, the days when a man is credited with coal are the days he is supposed to be at work, and he usually is, but they cannot be recognised as a perfectly correct record. In the same mannner the monthly earnings are not necessarily the amounts earned by a full month's labour, but such as the man is credited with on the pay-roll for a given calendar month; sometimes, too, the labour and earnings of a father and son, or two or even more men, are represented in a single account with only one of the actual workers. With regard to other employees in and about mines, they are paid by the week or month, and their time record is accurate.

A comprehensive investigation was made at a number of the principal mines in the State of Illinois, and statistics compiled, embodying the records of many thousand men, and showing just what each man had done and what he had received. The condensed results show that the average running time at the mines during twelve months was 213 days, the full time 281, and the possible time 306 days. The number of days' work done per month was 15·9 out of a possible time of 25·5 days per month, or a total for the twelve months of 190.8 days out of a possible time of 306 days; thus the miner found it possible to work only 62 per cent. of full time. The average daily earnings of the miner were 9s. 2¼d.; but the average monthly earnings amounted only to £7 6s. 6¼d., or £87 18s. 3d. per year, which gives a more definite conception of the actual revenues derived from labour performed. The average number of tons of 2,000 lbs. mined per man was 78·9 per month, or 4·8 per day. Only 23 per cent. of the number employed worked continuously for twelve consecutive months or more, which illustrates the amount of surplus labour about mines, and the constant change in the *personnel* of the working force.

Missouri.—The labour report for 1889 refers to miners, and it is there stated that 13 per cent. of employees in Missouri coal mines receive less than 3s. 1d. a day; 32·1 per cent. receive less than 4s. 1d. a day; only 51·5 per cent. receive more than 8s. 9d. a day. From enquiries among the men it appears the average income per family is £105 11s. 3d. a year; the average number of persons working per family was 1·4, making the average income of each person working £74 11s. 8d. The average amount expended in the year for food per family was £43 12s., of which £12 6s. 7d. was for meat. Rent averaged £12 1s., and clothing £17 5s. 9d. per family, or £3 9s. 5d. per individual, the average number in each family being 4.98 persons. The average total yearly expenses of each family was £97, of each individual £19 9s. 3d., and of each adult £32 7s. 9d.

Iowa.—With regard to miners the conclusions arrived at in Iowa are admitted to be less reliable than in other occupations, as the books of a mining company are ambiguous, and the men, who always work on check numbers, are paid by the lump coal they produce at a stated price per ton; as before observed in the part relating to miners in Illinois, these pay rolls show the number of days a miner puts out coals, not the number he worked, and the number of miners is not in all cases correct, as a miner may be assisted, perhaps, by his son, but only one person receives the pay on the check number. According to the Census report issued March 1891, the average yearly earnings for Iowa coal employees are £87 9s. 11d., or 5s. 8¼d. a day, allowing 308 working days in the year; but as these conclusions are arrived at from averages based on dissimilar units, it is considered safe to say that after deducting expense of powder, oil, and smithing, the earnings of coal miners will not average above 4s. a day in that State. In some States the real earnings of miners are still less, while in Kansas, Wyoming and Colorado they are more. The average loss of working days in the year in coal mines is about two-fifths, and it is reasonable to calculate a similar loss of working time in Iowa.

Colorado.—At the mines ten hours constitute a day's labour in ordinary work, and in some mines ten hour shifts only are employed; engineers and foremen usually work twelve hours. In heavy labour in some portions of the work, and in one or two mines, eight hours is a day's work. Miners are mostly paid by the month and their daily wages ranged in 1888 as follows:—

Occupation.	Highest.			Lowest.		
	£	s.	d.	£	s.	d.
Miners	0	16	6	0	10	4
Foremen	1	4	6	0	16	6
Timbermen, blacksmiths	1	0	7	0	14	5
Carpenters	0	16	6	0	12	4
Engineers, pumpmen	1	0	7	0	16	6
Firemen	0	14	5	0	8	3
Ore sorters	0	12	4	0	7	2
Labourers	0	10	4	0	6	2

Minnesota.—With regard to miners, who are stated to work twelve months in the year, the average annual earnings, as mentioned above, are calculated at 312 working days; but it is presumable that few, if any work that number of days in the year, therefore in their case, and possibly in some other occupations, the sum stated to be the average annual earnings would appear to be rather the possible than the actual earnings, and the months to represent the time during which it was possible to work, not the actual number of days worked.

First Quarterly General Meeting of the Mining Society of Nova Scotia—A Successful Gathering of the United Mining Interests of the Province.

The first regular Quarterly General Meeting of the Mining Society of Nova Seotia was held in the rooms of the Society at Halifax, on Friday, 17th inst.

Morning Session.

Among others present were: H. S. Poole, A.R.S.M., Acadia Coal Co., Stellarton, N.S.; John E. Hardman, S.B., M.E., Oldham Gold Co., Oldham, N.S.; Capt. G. MacDuff, Palgrave Gold Mining Co., Waverley; J. M. Reid, Oxford Gold Mines, Musquodoboit Harbor; C. E. Willis, Halifax; J. S. McLennan, International Colliery, Bridgeport, G. J. Partington, Whiteburn Gold Mining Co., Whiteburn; E. D. Davison, Bridgewater, N.S.; T. R. Gue, Halifax; J. R. Lithgow, Glace Bay Mining Co., Halifax; H. A. Budden, Intercolonial Coal Co., Montreal; B. G. Gray, Halifax; Duncan McDonald, Truro; J. H. Austen, Halifax; George W. Stuart, Truro; Dr. E. Gilpin, Jr., Inspector of Mines, Halifax; Charles Archibald, Gowrie Coal Co., Cow Bay; Lueius J. Boyd, Waverley; Dean S. Turnbull, Empress Gold Mine, Beaver Dam; Howard Clarke, Halifax; W. G. Matheson, New Glasgow; G. E. Franeklyn, General Mining Association, Halifax; H. M. Wylde, Secretary, Halifax; B. T. A. Bell, Editor CANADIAN MINING REVIEW, Ottawa. Mr. H. S. Poole, President, in the chair.

The Secretary read the minutes of previous meeting and presented the report of business transaeted by Council since last meeting, which were confirmed.

MR. JOHN E. HARDMAN, Oldham, moved, seconded by Mr. J. S. MeLennan: "That whereas by resolution passed on the 12th of May last, the Gold Miners' Association of Nova Scotia does hereby express its willingness to amalgamate with the Mining Society of Nova Scotia, under that name and title, to transfer to that society the assets, debts, and lists of the Association, therefore be it resolved that the Mining Society of Nova Scotia does hereby accept the membership of the said Gold Miners' Association of Nova Scotia, with its assets, debts, property and list of members."

MR. H. M. WYLDE, in answer to an enquiry, stated that there was a sum of $65 in the treasury of the Gold Miner's Association with no liabilities worth speaking about. The resolution was carried unanimously.

The Coal Royalty.

THE CHAIRMAN—An important question coming up to-day for further eonsideration was that in respect to the recent levy of an increase in the royalty on coal. Possibly it may appear that this was a question affecting the coal members of the society only, and perhaps it might be better left in the hands of a sub-committee of the present meeting to discuss what steps should be taken regarding further action. Perhaps it would be necessary to approach the Governor-General in Council with a memorial praying for its disallowance. It was a question which had not been decided by Counеil.

MR. G. J. PARTINGTON—The question, sir, is one which affects the whole mining community—the gold and iron and gypsum—as well as the coal operators. If the right of the government was admitted in this instance, it might be extended and inereased on the output of gold also. A discussion on the question might adduce some new points.

MR. C. ARCHIBALD—I quite agree with Mr. Partington that the matter affected the gold mining interests as well as the coal. A general diseussion would enlighten the meeting and the matter could then be committed to a sub-committee to report later in the day.

MR. J. S. MCLENNAN—It would expedite matters if the sub-committee dealt with the matter first and then make some reeommendation or report which could then be discussed by the society. He would move that the chairman name suеh a sub-committee to consider the question and report at the afternoon session. The motion was carried.

THE CHAIRMAN named Messrs. McLennan, Budden, Archibald, Francklyn and Lithgow, as a sub-committee.

A United Mining Convention at Montreal.

THE CHAIRMAN—Mr. Bell has, I understand, some suggestion to submit from the General Mining Assoeiation of Quebec?

MR. B. T. A. BELL—At a reeent meeting of Council of the General Mining Association of Quebec, a suggestion was made to hold a united mining convention at Montreal next year. With this object in view, negotiations had been entered into with the American Institute of Mining Engineers and other bodies, and replies favorable to holding such a convention had been received. The idea was to invite all the Canadian Associations to unite with the leading mining men of the United States in discussing such questions as mining legislation and mining practice. Papers on the mineral resources of the various provinces and their development, would be submitted, and would doubtless do much to attract the attention of capitalists to Canada as a good field for investment. The order-in-council respecting the free admission of mining machinery not manufactured in the country would expire next year, and he thought that if a well directed move was made, this beneficial legislation might be renewed for another period. Our Association would be pleased to have the Mining Society of Nova Scotia in conjunction with the other Canadian Associations, unite and co-operate in carrying out a programme for such a convention.

MR. JOHN E. HARDMAN—Speaking personally, I am heartily in favor of Mr. Bell's proposition. The question as to whether we should go as a representative body or as individuals might, however, be left in the hands of the Counеil.

MR. B. C. WILSON—It might be well to appoint delegates.

MR. B. T. A. BELL—The idea was not only to have a representative attendance, but also to have the Province of Nova Scotia represented by papers on its resources, mineral development, mining legislation, and such subjects of peculiar interest to itself.

MR. JOHN HARDMAN moved, seconded by Mr. Archibald: That this Society expresses itself as favorable to the idea of a united convention, to be held in Montreal on or about the 23rd of February, and the matter be referred to the Council to report at the next Quarterly Meeting.

The motion was carried unanimously.

New Members.

On the motion of Mr. C. E. Willis, Dr. Haley, President of the Newport Gypsum Mining and Manufacturing Co., Windsor, was elected a member, and Mr. Hugh McD. Henry, Q.C., was elected an associate member of the Society.

Revision of Constitution.

After some informal discussion on the classification of the roll of membership, it was resolved, on the motion of Mr. Hardman, seconded by Mr. McLennan, "That the Constitution and By-Laws of this Society be submitted to a special committee, composed of the following members: H. S. Poole, J. E. Hardman, R. G. Leckie, B. T. A. Bell, G. W. Stuart, J. S. McLennan and the Secretary, for revision, and report thereon at the next Quarterly meeting."

The Society's Rooms.

MR. BELL said that it was very gratifying for the members to be able to meet to-day in the very comfortable and commodious quarters which their genial friend Mr. Gue has so thoughtfully provided and so generously furnished for their use, and he moved, with great pleasure, that the hearty thanks of the Society be conveyed to Mr. Gue. Mr. Stuart seconded.

THE CHAIRMAN expressed gratification that the Society was housed at present in such excellent quarters, and upon such excellent terms—freely and unostentatiously given. He had much pleasure in tendering to their kind host the unanimous and hearty vote of thanks of the members of the Society.

The meeting then adjourned until 2.30 p.m.

The Coal Royalty.

Messrs. Budden, (chairman), Francklyn, McLennan, Archibald and Lithgow, the sub-committee on the coal royalty increase, met immediately afterwards and held a private session. Mr. Lithgow read extracts from a correspondence he had had with the Hon. W. S. Fielding, Provincial Secretary, (published in full elsewhere). Letters were read also by the chairman. It was understood that the committee recommended that a memorial to the Governor-General-in-Council be prepared and presented to the Hon. the Minister of Justice at Ottawa, praying for the disallowanee of the recent legislative enactments of the Nova Scotia Government in respect to the increased royalty.

Afternoon Session.

Members met at three o'clock, the President in the Chair. The sub-committee on coal royalty reported in favour of a memorial to the Governor General-in-Council.

MR. C. ARCHIBALD said that the members of the Cape Breton Coal Miner's Association were willing to bear their proportion of the expenses incurred in thoroughly testing the increased royalty law in case the same should be taken to the courts, or in the event of any memorial being submitted.

MR. J. S. McLENNAN moved that the report of the sub-committee be adopted.

MR. JOHN HARDMAN seconded the motion. Carried unanimously.

Exhibits for the World's Fair.

DR. E. GILPIN, Inspector of Mines, said that the Government had appointed an advisory board in connection with the Chieago Exhibition. The Government wanted to make an exhibit of the mineral resources of Nova Scotia as complete and representative as possible, and Dr. Saunders had informed him that they could have as much space as they required. It was also intended to be represented by an exhibit of their fisheries, forests and fruit resources. He mentioned the latter in case any of the gentlemen present might have an opportunity of pieking up exhibits. With regard to valuable gold speeimens he was afraid they could hardly expect specimens to be presented gratuitously for the purposes of the exhibition, but he thought some suitable arrangement might be made with the Government for the use of the same. He would be glad to have suggestions from the members, and hoped that the miners would all co-operate and do what they could to assist in making an exhibit that would refleet credit on the Province.

MR. J. M. REID—I have a few nuggets that are at the Government's service, provided it will guarantee their safe return.

THE CHAIRMAN—They will be insured by the Government.

MR. T. R. GUE presumed that proper precautions would be taken to ensure their safety and safe return.

Mining Engineers to be Qualified.

DR. GILPIN, continuing, said there was a movement on foot by the Canadian Society of Civil Engineers to have a statute enacted whereby only qualified engineers should be admitted to practice. The matter was of great importance to the mining engineer and the mining community generally, and he suggested that the Society take some steps to help this matter along. In conclusion, he directed the attention of the Society to the remarks made by Mr. Hugh Fletcher, B.A., in his report for the members of the Geological Survey of Canada to the Civil Service Commission, having particular reference to a wider distribution of the survey reports and maps.

The First Crushing Mill in Nova Scotia.

MR. C. E. WILLIS pointed out that at Chizzetcook was to be found the first gold crusher used in Nova Scotia. The first method praeticed of extracting the gold from the quartz in this Province was at Mooseland where they made a hole in the ledge rock and used a pestle. The first mechanical mill was built at Mooseland. It was afterwards taken to Tangier and is now at Chizzetcook, the property of Mr. Graves of Boston. The mill should be secured and preserved as a relic of the crude methods of working in vogue in the Province thirty years ago. It could be got at small expense. I have received permission from the officials of the Public Gardens at Halifax to place it there for safe keeping, if it can be obtained without any expense to the city. Mr. Partington, the agent of Mr. Graves, assures me that he can obtain the mill. The expense of placing it in the Gardens would amount to about $25 at the outside. I would move that this Society assist in placing this mill in the Gardens as a permanent exhibit of the old methods of gold mining in Nova Scotia.

MR. G. J. PARTINGTON—I have great pleasure in seconding Mr. Willis' motion.

The motion was put to the meeting and carried unanimously.

MR. CHAIRMAN called upon Dr. Gilpin to read his paper.

Notes on Nova Scotia Iron Ores.

DR. GILPIN—I do not pretend to claim any degree of originality for these notes, as I treated the subject in some detail in a paper recently read before the Canadian Institute of Civil Engineers. It occurred to me that as you had a paper on explosives, one on gold, and the names of two men prominently connected with coal mining were down on your list, I might complete the cycle by taking up the subject of iron ores.

Historically speaking, the history of iron ore mining and smelting in Nova Scotia, as well as in the Dominion, is a disheartening record of ill-advised starts and subsequent failures. A few exceptions stand out prominently. Bartlett, in an interesting paper published a few years ago, gives a succinct account of the progress of iron working in Canada, and many valuable statistics showing the amount of our imports of iron in its varied forms.

I may perhaps give a glance at the relative positions of the chief geological horizons recognised in the Province, in some one of which each of you is more specially interested. The differenees of the more profound geologists as to the exact equivalents and ages of some of these rock masses need not be dwelt upon in this connection, especially as you will find that the geographical and geological relations of the iron ores are somewhat in unison. We have, therefore:—

The modern or surface soil.
Trassic sandstone and trap.
Carboniferous, including permo carboniferous, upper coal measures, true coal measures, marine limestone, lower or basal carboniferous.
Devonian, Oriskany sandstone, etc.
Upper Silurian—Clinton, lower Helderberg.
Lower Silurian.
Cambro-Silurian.
Lower Cambrian—Longmynd.
Laurentian.

All the above horizons carry iron ore, some in large amounts, others in quantities not yet recognised as of value, except the lower Cambrian, the slates and quartzites of our gold fields. I have never been able to hear of any deposits of iron ore in them in any way promising to be of importance. The only occurrence of iron ore I have seen was a bed or seam about three inches wide a few miles west of Goldenville. It was a soft limonite, and may have been the result of oxidation of iron pyrites. Some of you who are more intimately acquainted with our granite and the gold-bearing strata may know of deposits of iron ore in them. The subject is interesting, for it is rare to meet so large a series of rocks abounding in many plaees in beds containing a good deal of ferruginous matter, and traversed by faults and foldings, not holding more or less segregated bodies of iron ore. Near Grand Lake there are some exposures of red hematite which were reported as belonging to the gold measures. Those that I saw were contact deposits between carboniferous conglomerates and grits and black slates belonging to the upper part of the gold-bearing rocks. In this connection I do not, of course, allude to the beds of bog iron ore which are not uncommon in the gold districts. The value of a good bed of iron ore on the Atlantic coast, within easy reaeh of shipping, would be considerable and might be greater than of some gold mines. It may be remarked that, as the auriferous rocks of the Province show little trace of fossils, the iron ore beds, if found, might prove comparatively free from phosphorus.

The bog iron ores which occur at numerous points in Nova Scotia in connection with the sites of swamps will

prove of interest to our furnace men in the future. They are worked to some extent in Quebec for local furnaces. They are too low in iron and too high in phosphorus to be available for export, or to be in demand for other than foundry purposes. Their method of formation is interesting as illustrating the aggregation of the sedimentary ores of iron in almost every age. Waters containing carbonic acid, dissolving iron from the strata they percolate by means of certain complicated combinations, deposit it again when they flow into water highly charged with vegetable matter. In some cases the result is only a sand charged with ferruginous matter which will harden into a rock containing a few per cent. of iron. In other cases the resulting bed as now presented will contain a preponderance of iron, with percentages of silica varying from a minimum up to one rendering it valueless to the furnace man. An instance of this is met in Pictou County, where the bed is composed of fine grains of sand, each grain coated with iron oxide. At one point the coating of ore is so thick that analysis shows it to contain some 50 per cent. of metallic iron; gradually, from the richest portion of the bed, the coatings grow thinner, as it is followed right and left, until it becomes a ferruginous sandstone, and finally a coarse sandstone. These ores as met in Pictou county and at other points which have come under my notice, by some process in the alchemy of nature are usually free from phosphorus. When, however, the deposition of iron oxide took place upon a layer of sand or marl abounding in the "fossil" forms of the particular horizon, which may have been either an ancient lake or even a salt water bay, etc., not only are the casts of the fossils retained but the ore is generally phosphoric. I allude here more particularly to the bedded red hematites of the Clinton, etc.. in Pictou county. At one time these beds may have been higher in grade over wider spaces than they are now, and it is easily credible that in the long periods that have elapsed since they were laid down they may in turn have been themselves subjected to the action of waters capable of leaching out some of their iron. The presence of small crystals and veinlets of quartz in them would be some proof of a process of replacement.

Passing for the present to the carboniferous measures, we notice that "clay ironstone" ores occur in all parts of it. I am not yet aware that they have been met in quantities to excite the cupidity of the miner. It is in the carboniferous marine formation, best known to the general public from its gypsum and limestone and good farming lands, and in the underlying or basal conglomerates or shales, that we meet our most interesting deposits of iron ore. In addition to the nodular layers of carbonate of iron there are, at two or three points, beds of the purer variety known as spathic ore.

As, for the purpose of this paper, the carboniferous may be considered the latest formed rock series of the Province, as well as one of the most extensive, it is evident that as it ranges through the country it must rest now upon one, now upon another of the earlier formed rocks. It thus occurs resting upon granite, Devonian, Silurian, Cambrian, Laurentian, etc., always of course, unconformably. These junctions are always of interest to the student of field geology. You are probably all acquainted with the celebrated Gays River district. Here the conglomerates rest on the gold measures, with a layer of fine detritus between. At other points sandstones and shales rest on the older rock, like layers of plank and boards butting against a brick wall, or have the point of junction cemented with silicious, calcareous, or felspathic matter, and often fragments of the older rock abound in the newer along the plane of contact. When limestone forms the later rock the passage from the pure limestone to the slates is often gradual.

It will be readily understood that these lines of junction form natural highways for the passage of underground waters. These waters, governed by no law we are cognizant of, frequently exert their powers to give us junction deposits of iron ore. A glance at the contact deposits of Pictou county will serve as an example of the limonite deposits. Here the marine limestones come, at many points for considerable distances, in contact with Silurian slates. Evidently denudation has swept away many feet of measures, a process hastened by the access afforded to water by the planes of contact, and by the lines of faulting which frequently characterize newer rocks at their junction with older strata. As this went on the particles of iron ore gathered from the older slates, as well as from the carboniferous strata, were accumulated at every opening. As the limestone was moved it was either replaced by the iron oxide or the channels of the water currents were filled with it. In the Whitehaven district in England there are many interesting examples of the replacement of masses of carboniferous limestone by iron ore, and of the filling of channels and crevices in it by the same means.

So complete and, if I may use the words, "so carefully conducted" has been the replacement of each particle of limestone by one of iron ore, that the lines of bedding and the fossil remains have been preserved. This melting down of great masses of limestone, and accumulation of masses of limonite, is well illustrated in Pennsylvania, in some of the Silurian limestone districts.

In the case of the contact deposits between the basal carboniferous conglomerates and the older rocks, the process has presumably been somewhat similar. These ore bodies are often irregular and thicken or thin out rapidly. The thicker bodies represent perhaps the line of most decided action, and the points where the boulders of felsite, granite, slate, whin, etc., were removed and their place filled with iron ore. As the attention of the miner is turned from the main body of iron ore he finds that while perhaps a thin seam follows the line of junction, the power acting on the conglomerate has become weaker. The ore when broken shows inclusions of rock; gradually the percentage of more or less changed rock grows greater, until only the surface of the boulders has been transformed into ore; finally the only indication left is the replacement of the original silicious or calcareous bond of the pebbles by one of iron oxide. Often the process has not advanced beyond a thin film of ore at the point of junction, or a coating of the boulders. I think I am correct in saying that the limestone contact formations here are limonites, often varying in their water contents, and sometimes manganiferous, while the contact deposits making the basal carboniferous rocks are hematites. This presumably is merely due to greater age and slight metamorphic action.

Descending once more in the geological scale, the next notable deposits are the bedded hematites, sometimes magnetic, of the Laurentian limestones, as met at Whyhogomah and East Bay. There are always conflicting theories with regard to the modes of formation of every mineral deposit in this wonderful horizon, and I will not detain you beyond remarking that to the miner these deposits appear in their ore contents, relation to surrounding rocks, etc., to resemble closely those of Pictou and Annapolis counties, always called "beds," and to suggsst their having been formed in a somewhat similar manner.

The vein deposits of limonite at Londonderry and of specular iron ore at the East river, Pictou county, appear to have accumulated in a fracture running with the general course of the strata, and to have been accompanied by replacements of country rock by carbonates of iron, lime and magnesia, and more or less secondary segregations of iron ore.

This brief and imperfect glance over the classes of iron ore presented in Nova Scotia may prove interesting to the miner as well as to the geologist and the student of mineralogy. The miner, whose interest it is to extract the best ore at the cheapest rate, need not concern himself with the disputes of geologists, but he must thank them for the classification of the facts gathered by many generations of his predecessors. His outlays on junction deposits must be more carefully made than in bedded deposits; his preliminary work more particularly directed to proving ore in advance; his attention directed to the variations in quality due to the modifying effects on his ore of the different strata it was influenced by during the process of formation. When mining the bedded deposits he must be guided by the motto, "All that glitters is not gold," for the grade of his ore and its sulphur and phosphorus contents continually vary. Still he has the advantage of a longer stretch of reasonably assured regular workings. If he is to win ore from a vein, the skill of his foreman and their unremitting study of the working faces have to be invoked to assist him in laying down the best rules for following leaders, slips, and for meeting the host of curious changes every vein shows as it is followed.

As I feel that this rambling paper, which was designed to provoke discussion, has reached its limits, I will close, with the hope that all members of the Association will give it the benefit of the curious or anomalous phenomena they meet in their mines, for brief notes on such points are very valuable from the discussion following them.

Discussion.

MR. JOHN HARDMAN wished to know whether the deposit of iron ore at Grand Lake was red or brown?

DR. GILPIN—It is apparently a red hematite.

MR. HARDMAN—Is it silicious?

DR. GILPIN—Yes.

MR. WILLIS said that about four years ago he was down at Lockport, and on the beach, and for a mile along the shore he found masses of brown hematite ore. It is a granite formation. Evidently there was a large deposit of brown hematite in that vicinity.

DR. GILPIN—I was going to say that boulders of brown hematite are not uncommon about Bedford and Sackville.

THE CHAIRMAN suggested that they might have drifted from Lake Rossignol.

DR. GILPIN. It would not be further than from Londonderry or from Truro.

On the Introduction of New Explosives for Coal Getting in Nova Scotia.

BY H. S. POOLE, A.R.S.M., F.G.S., STELLARTON.

The selection of the writer to present to this Society a paper on the introduction of new explosives in our coal mines has been solely made because in the pits under his charge there has been a larger consumption of the so-called flameless explosives than elsewhere in Canada.

He has nothing new beyond the practice in question to speak of, and the following notes have been put together with that understanding.

The quantity of inflammable gas met with in several of the pits of Pictou County, early pointed to the extra danger there attending the use of ordinary blasting powder, and led to the drafting of strict rules governing the firing of shots in coal long before mining legislation made similar precautions compulsory. Until lately, when from the free evolution of fire-damp in any workings, the risk accompanying shot firing seemed excessive, the only alternative open to the miner was to abandon powder altogether and fall back on "mall and wedge."

But in Europe the possibility of preparing explosives making less flame than powder, engaged the attention of chemists for many years, and met with marked success. Recent legislation has forced this foreign experience on the notice of all our coal operators, in consequence of the undoubted additional risk that has been proved to attend the use of common powder in pits of a certain character. It is not proposed to follow step by step the enquiries made by royal commissions in Prussia, Austria, France and England, nor to refer to the various compounds which seemingly can be used as substitutes for powder in coal getting. The several reports are summaries of them which have been given in colliery periodicals.

Some four years ago no explosives of this new class being then available in this country, shot firing stopped in the Acadia pit at Westville and shortly after powder was also given up in the adjoining Drummond mine on the same seam. As yet in the former no other explosive has been introduced, the coal working freely under the pressure entailed by the depth of cover, now some 1,500 feet, vertical over the levels of the eighth lift. At the time the use of powder was abandoned in these pits attention was drawn to the advantages and decreased risk accompanying the firing of shots in Germany with such compounds as carbonite, though the difficulties of importation then barred its adoption in this Province.

Trials, however, were made with blasting gelatine and water cartridges, which, though flameless, did not seem to promise satisfaction in pits where the character of the coal required a large number of shots to be fired each day, say three in each working place each shift. It was found, so slow was the process of tying each charge in its bag of water, that in such a pit as described an army of shot-firers would be necessitated; besides, it was felt in the desire to hasten the preparations that a comparatively large percentage of shots would undoubtedly lose the water envelope and hence might show flame, besides the size of hole the water cartridge required was another objection. Previously, it should be added, an attempt was made at Sydney mines to bring down coal with lime, but it was not proceeded with.

Later on the Acadia Powder Co., with works at Waverley, took up the question of flameless explosives and prepared several samples. These were practically tested in the Vale pit in April, 1890. When fired under confinement they all proved flameless, even when the stemming was blown out under conditions that with powder would have produced an abundance of flame. The work done by these samples was, however, irregular, and the detonation sometimes imperfect—to remedy which defects further experimenting was necessitated. In the meantime a local company started at Halifax the manufacture of roburite, the best known preparation of its class in use in England. But before relating in detail the experiences connected with the practical application of these two compounds supplied by the Roburite Company and the Acadia Powder Company, a few remarks of a general character on the subject of explosives may interest men, who, like the writer, had not previously given the matter attention.

At the same time it is proposed to mention in a very summary way the theoretical grounds for believing black powder should be excluded from certain coal mines.

All engaged in coal mining are aware that the workmen with one voice contend that there is no blasting material to compare with powder for bringing down coal; nor is this preference confined to colliers. Mining engineers of repute are also to be found who insist that for certain strata no other explosive can touch powder. This view has been put down to prejudice, especially by the champions of new compounds, who may be as positive as their blasting experience is limited, and it may be worth while to consider whether these practical men have any theoretical ground in favor of their contention.

To those familiar with explosives, much that is here given will necessarily appear very rudimentary, but possibly to others the points that were found of interest to the writer may also prove so to them, now especially when legislation brings into disrepute gunpowder without offering to explain why it is considered more dangerous than some other materials of similar nature.

The Cape Breton miner who knows that in his County some 19,000,000 tons of coal have been won by the probable consumption of some 1,500 tons of powder without the occurrence of an accident involving the lives of as many even as three men, cannot see wherein lies the danger that is in excess of other sources of accident to which he knows he is exposed. The additional risk which long immunity has shown to be fractional, he is willing to take, especially as in efficiency, cheapness and convenience, a change from powder, so far as he knows, is not for the better. He knows that dynamite and its allies are too quick in action, shatter the coal too much and make a larger percentage of small coal than powder, which brings down more coal shot for shot, and rends away from the face the coal in larger masses by its progressive action. The special danger attending the use of powder has not as yet, fortunately, shaken his nerves, so to find the necessary experience we have to look at the mines of Cumberland and Pictou Counties. In these counties inflammable gas is often freely evolved and the roadways and walls of the working places covered with a fine dust noticeably worse in cold than in warm weather, and where these conditions exist a blown-out or "ground shot," emitting a stream of flame and sparks a distance, it may be, of six or eight yards, has a very ugly look and suggests the worst of possibilities.

Prior to Nobel giving to the world his investigations with nitro-glycerine, which revolutionized the manufacture of explosives, the mixtures generally employed were all of one class, combustible as gunpowder, and composed of substances that have so strong a chemical affinity that

they combine and generate gases with rapidity on the application of heat. Under confinement, this sudden evolution of gases causes explosion, but unconfined there is rapid combustion only.

In the manufacture of powder for different purposes, changes have been made in the relative proportion of the ingredients, in the purity of the materials, in the size of grain, and in the substitution of substances chemically equivalent—the latter often to cheapen the production, as in the substitution of nitrate of soda instead of nitre. The remarkable influence in the quality of the charcoal used was early noted, certain woods furnishing superior charcoal to others, but the greatest stride in this direction was in the adoption of some straw fibre, and that imperfectly carbonized. At least it is reported that cocoa powder largely owes its exceptional efficiency to this innovation, although of course rival manufacturers who sought to discover its composition had no difficulty in at once noting that it contained an unusually small percentage of sulphur, 3 per cent. only, while the ordinary mixture in gunpowder ranges near 10 of sulphur with 15 of charcoal and 75 of nitre. Whatever may be the composition of cocoa powder, the change made has given it a progressive quality at the moment of explosion not attained by any previous mixture.

The better to understand the theoretical source of danger attending the use of powder, it may be well to consider the experience gained in the study of the relation of powder to guns for military purposes and see wherein it applies to the question before us. To begin with, it is necessary to distinguish between the ignition and the total combustion of powder; to note the rapidity with which the heat resulting from the burning of one grain spreads the conflagration to adjoining grains, and the entire consumption of each grain. Thus it is found the larger the grain the quicker the ignition, but the slower the combustion. This property is taken into consideration in the preparation of powder for different purposes, and explains why small-grained and mealed powder are used in fireworks and large grains in cannon proportionate to the length of the piece. In the former the communication of burning from grain to grain is purposely made slow, although the total decomposition of each grain, being small, is soon effected.

For military purposes to obtain a continuously increasing propulsive force that will develop a low trajectory, the rapidity of combustion of powder has been regulated by the composition, the relative percentages of the ingredients in the mixture, as well as the size and shape of the grain.

For guns of different sizes special powders are prepared, the size of the grain varying with the object of producing inital pressures at the breech of the gun as low as possible, at the same time maintaining a progressive action behind the projectile as far as the muzzle without the explosion of unconsumed powder. The most modern form of large grain is understood to be a pierced hexagonal prism. Although powder has been so long known, a great improvement has been effected in its efficiency within the last twenty years. Instead of imparting to the projectile an initial velocity of 1,500 ft. per second as a maximum, a flight at the rate of 2,500 feet per second has been attained of late; at the same time the internal pressure exerted by the explosion of the charge in the gun has been diminished from 20 to 13 tons per square inch.

For mining purposes, where a progressive action is desirable, as in rending down coal, the size of the grain of powder has something also to do with success; and the quantity of powder used should be proportioned to the depth of the hole and the work to be done. But the object the miner desires to attain differs somewhat from that of the artilleryman; the one looks to expel the stemming without fracturing his piece, the former to cause the tight tamping of the stemming to rupture the breech of his gun, and this disruption necessitating a new bore-hole, for each shot debars him from experimentally proportioning his charge so as to avoid the explosion of some unconsumed but ignited grains of powder into the atmosphere. It is this emission of ignited but unconsumed grains that is so dangerous in the case of dry and fiery mines. There is also in the explosion of powder a large amount of heat evolved which further expands the gaseous product of combustion and also projects into the atmosphere the solid residue at a high temperature. An additional objection to the use of powder in a dry hole occurs when the coal dust is left in and adds to the inflammable material. The combustion of this excess of carbon is imperfect and produces the deadly carbonic oxide which when heated burns in contact with the oxygen of the air and generates more heat. For a time in England a compressed form of powder has been found convenient, but for the reasons stated above it is considered somewhat more dangerous than the ordinary form.

Having shown some of the sources of danger attending the use of gunpowder in fiery pits, we have now to consider in what direction safer explosives have been sought. More or less success was found to attend the mining or enveloping of high explosives with salts, such as alum, that contain a large percentage of water of crystallization. The earlier Prussian and Austrian commissions recommended the admixture of carbonate of soda. Soda-witter-dynamit contains 40% carbonate of soda and 60% of dynamite; its explosive force is low and it freezes at 45° Fahr., and what is worse, at a temperature of 95° Fahr. it loses water of crystallization, which causes the nitroglycerine to exude.

Partial success was attained with wet moss as stemming. Then it was shown by experiment that dynamite and other high explosives did not give a flame if the stemming exceeded 16 inches, but that with less they gave a flame that ignited gas; so again, when dynamite is burnt it will ignite fine coal dust, but when exploded no combustion takes place. Other experiments showed dynamite alone would not fire a 5% mixture of gas and air, but would fire one of 8%. One great objection to carbonate of soda is that this salt is inert, so that when ammonia nitrate was substituted a great step in advance was taken, for it is explosive besides possessing other advantageous qualities, its temperature of detonation is comparatively very low, 1832° Fahr., and not only is its combustion perfect, but it generates free oxygen.

$N_2H_4O_3 = N_2 + 2\ (H_2O) + O.$

The value of this free oxygen lies in ensuring a perfect combustion of the other ingredients of the explosive mixture, which, in those preferably employed, are nitro compounds; that explosion leaves their components completely oxydized. This quality was shown to be absent in gunpowder, which has uncombined elements eager to seize on the oxygen of the air on being liberated by an explosion.

Another source of safety was contended for by the later French Commission on explosives in the appreciable length of time taken by mixtures of fire-damp and air to combine.* Experiments went to show that it was actually possible to have a detonation generating flame that will not ignite fire-damp by having the temperature of detonation sufficiently low.

Marsh gas, the ordinary fire damp, $C\ H_4$, detonates at a temperature of 4000° Fahr., so that a mixture having, say a temperature of 3000° Fahr. is a safe explosive. It will be noted in the following table that gunpowder generates a temperature very little in excess of that shown by an explosion of marsh gas:—

	FAHR.
Nitro-glycerine	5700°
Nitro-mannite	5700°
Dynamite	5290°
Guncotton	4745°
Gunpowder	4015°
Fire-damp	4000°

These temperatures are all in excess of the assumed limit of safety, and yet it is contended by the French Commission nitro compounds can with safety be employed by reducing the temperature of explosion of any one of them, a lower average being obtained by a mixture with ammonium nitrate. The effect of a mixture being somewhat as follows:—

	FAHR.
30 parts gelatinized nitro-glycerine with 70 parts of ammonium nitrate yielding a temperature of	3450°
20 parts gelatinized nitro-glycerine with 80 parts of ammonium nitrate yielding a temperature of	2910°
12 parts gelatinized nitro-glycerine with 88 parts of ammonium nitrate yielding a temperature of	2730°

The explosive force of these mixtures being, in comparison with dynamite at 100, as follows: 122, 118 and 111 respectively.

Nitro compounds have the further advantage that the intense heat generated by the explosion wave is very local and the flame momentary and not extended by the oxygen of the air.

Still caution is necessary in generalizing, as the following records will demonstrate: A mixture of 30 parts guncotton and 70 parts am. nitrate, weighing some 1,540 grains, failed to ignite a gaseous mixture, but a charge of double the quantity with 20 parts only of guncotton and 80 parts am. nitrate, did ignite gas. Taking again the latter quantity with only 15 parts of guncotton and 85 am. nitrate, then the gas was not fired by an explosion of the mixture.

A similar experience was found when mixtures of dynamite and the ammonium nitrate were experimented with: A cartridge weighing 770 grains, composed of 60 parts dynamite and 40 parts of nitrate, when exploded unconfined, failed to fire a gaseous mixture, while one of double the quantity with the percentage of dynamite reduced to 50 and even 40, did fire the gas. On the other hand a second doubling of the quantity to over 3,000 grains accompanied by a reduction of the dynamite to 30 parts did not fire the gas.

These mixtures detonated completely with 8 grains of fulminate, but the decomposition was not complete when unconfined with less than 50 per cent. of dynamite. When confined a mixture of 20 parts of dynamite is completely decomposed.

The next step after treating with dynamite which leaves a solid and incombustible residue, was to substitute a nitrated hydro-carbon which was combustible and had no solid residue. Nobel's improvement consisted of substituting gelatine, a soluble guncotton, in place of the infusorial earth, the absorbent in dynamite, and he so produced a solid natural explosive throughout, and then by adding 10 parts of military guncotton, which is not soluble, he produced blasting gelatine of still greater power. It detonates easily with 11½ grains of fulminate

These compounds may be said to belong to the second great class of explosives for which confinement is not necessary to produce explosion, nor is combustion necessarily followed by explosion. When explosion does occur it is not by a rapid combustion as in powder passing from grain to grain, but an "explosive wave" is set up by a primary explosion, most conveniently, in practice, of some other material. The detonating substance generally employed is fulminate of mercury, so well known in the common percussion cap. Some explosives of this class require stronger detonation than others to produce the necessary dissociation of molecules, and the passage of an explosive wave through the mass varies seemingly with the intensity of the initial detonation. While a train of gunpowder, unconfined, burns at a visibly slow speed, the explosive wave set up by detonation in an unconfined train of guncotton has been computed to travel at a speed of 18,000 to 24,000 feet per second, practically instantaneous. The rapidity with which the explosive wave is propagated in this class of explosives explains the reason for the local shattering action following detonation, and gives a valid excuse for the objection of the coal miner to the general substitution of one of such compounds for powder in coal getting.

The action seems to be in the so-called explosive wave striking within measurable distance, compounds of this class, which may be either solid or liquid or gaseous, and producing dissociation of the component elements which in their nascent state reunite under the influence of the heat produced and form chiefly the simple compounds water and carbonic acid, leaving the nitrogen uncombined. This is the result in laboratory experiments; but in practice the products of explosion are of doubtful composition and probably vary with the environment, as for instance, where there is a space about the charge, or there is a partial combustion of the charge, or the momentary heat of the explosion causes the carbon of the fine coal dust about the charge to combine with excess of oxygen in the composition employed. In the latter case it is suspected danger may accrue from heated carbonic oxide coming through a fissure in the coal and uniting with another atom of oxygen from the air. This is only suspected as a possible complication under exceptional circumstances.

Reference has been made to carbonite, one of the earliest mixtures that was accepted. It is a mixture of nitro-glycerine, with an excess of carbonaceous matter, preferably wood-meal, which, in exploding, generates 15 per cent. of carbonic oxide.

Roburite is made of 14 parts of chloro-dinitro-benzol, with 86 parts of ammonium nitrate. Explosion under confinement breaks it up into water, carbonic acid and free nitrogen; no carbonic oxide being generated.

Gelignite, a compound in use in England, has 56½ parts of nitro-glycerine, 3½ parts of nitro-cotton, 8 parts wood-meal and 32 parts of nitre. It generates in explosion some 7 per cent. of carbonic oxide.

Ammonite contains 10 parts of nitro-naphthaline and 90 parts of ammonium nitrate. Produces no deleterious fumes and requires an extra strong detonator to explode it. Put up in metallic cases, cartridges are unaffected by wet. It is not frozen like dynamite. It has apparently many good qualities, but has only been tried experimentally, not being made in this country, and it is too costly to import.

Reported relative strength of equal weights:—

Ammonite	100
Roburite	94
Dynamite	85
Acadine	66
Carbonite	54
Gunpowder	45

Or taking

Blasting gelatine with ammonium nitrate at	100
Dinitro-benzol with ammoniun nitrate is	80
Dynamite with ammonium nitrate	75
Gun cotton with ammonium nitrate	72
Gunpowder	38

SAFETY IN HANDLING.

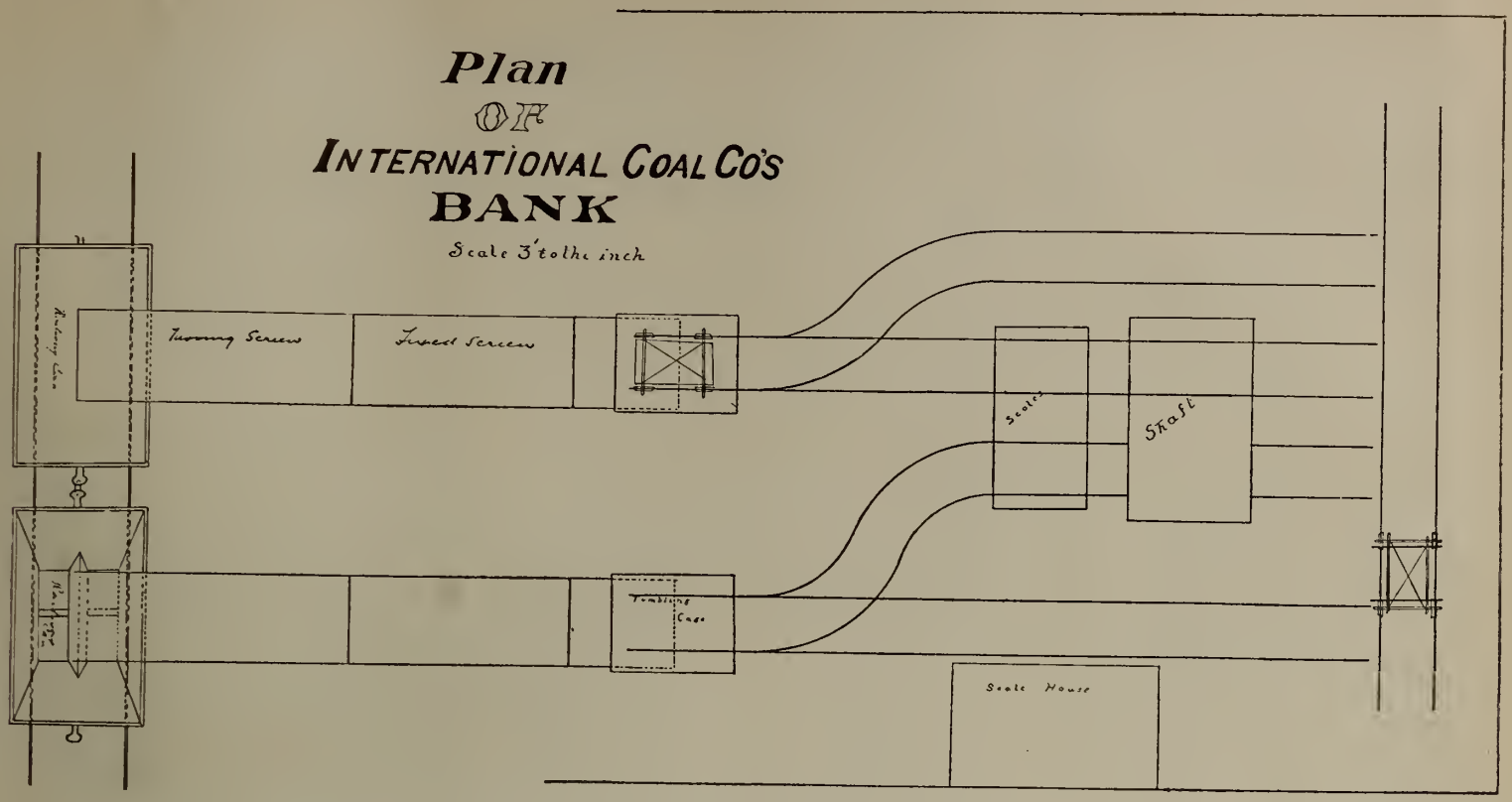
The makers of nearly all modern explosives claim their products can be handled with impunity, that packages of them may be let fall, that weights can be dropped on them from any height, and that they can be set on fire and will burn without explosion following.

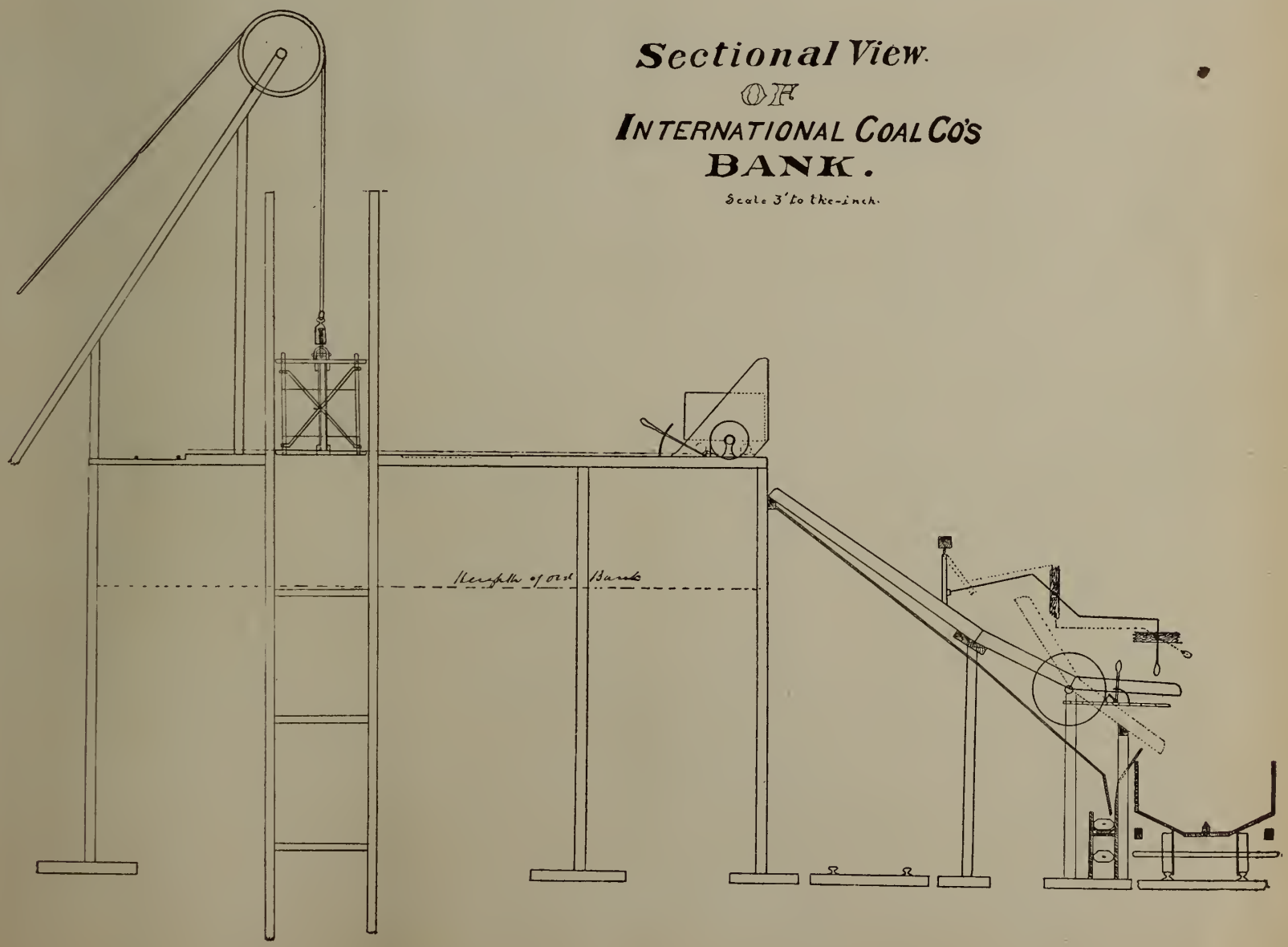
When dynamite was first introduced these advantages were also claimed for it, and there is no doubt dynamite has stood a great deal of ill usage without accident. The writer at that time, in the confidence of youth, held a cartridge of it in his hand and set it on fire; he has also seen a man enter a colliery store room and kick in, with his hob-nailed boot, the head of a 25 lb. keg of powder; but his curiosity for such experiments is satisfied; and now he prefers to see all explosives, regardless of their reputation, treated with respect. Dynamite, occasionally, has resented too great familiarity. In a paper read before the Society of Engineers, in 1889, it was stated, naturally enough, that the chief ingredient of flameless explosives, ammonium nitrate, was harmless, but it has since been shown that not only can it be detonated, though its detonation is uncertain, but that it also can be exploded in small quantities by percussion. It may, therefore, be assumed that it is impossible to be quite sure of any explosive, or of what products temperature, moisture, mixing, and decomposition may produce in time, and however remote the limit of safety may by experiment seem, that it is somewhere to be found may be relied on.

FUMES.

Nitro-glycerine and dinitro-benzol are both poisonous; the fumes of both when burnt are injurious to breathe, but

*NOTE.—This conclusion seems hard to reconcile with the knowledge that an electric current of high tension will fire a gaseous mixture, and that the passage of such a current is made in an infinitesimal moment of time. This knowledge would advise caution before trusting to obtain an element of safety in the contention referred to, especially when it is also known that there is a sharp line in the scale of mixtures of gas and air, which varies somewhat with the composition of the fire-damp, but which is about 7% of gas, when a mixture from being quietly combustible merely, becomes instantly a violent explosive.





TO ILLUSTRATE MR. MCLENNAN'S PAPER ON "CHANGES AT THE BANK OF THE INTERNATIONAL COAL CO."

only to a limited extent, if at all, when perfectly exploded. Men become inured to both, and soon find that the fumes of roburite are no worse than those of gunpowder. At the same time, as a matter of practice, it would be well if miners allowed a minute or two to elapse before rushing in to see the effect of their shots, as is generally the custom with powder in coal pits. This practice may have been advisable where there was fear of the shot setting fire to the feeders of gas, and it was desirable to beat out the flame before it got hold of the loose coal, but the same reason should not apply to the use of high explosives.

When first introduced, men talked a good deal about the fumes, although advised no ill effects would follow, while although cautioned against handling the material, some are disposed to do so unnecessarily, and make cartridges of a size to suit individual ideas, and in this dangerous practice they should be checked.

With acadine, as with all nitro-glycerine compounds, the nitrous fumes in an ill ventilated place are apt to cause headache, but when habituated men are known to speak of the fumes as less objectionable than the smoke of powder.

English experts on explosives make no mention of such a compound as acadine, no composition of ammonium nitrate with guncotton or nitro glycerine being licensed in Great Britain, and the reason for this is given in the blue book of 1890, as follows: "All ammonium salts, especially when exposed alternately to moist and dry air at slightly elevated temperatures, lose traces of ammonia and become acid. Nitro compounds like guncotton and nitroglycerine are seriously affected by traces even of acids, and decomposition once started goes on and ultimately leads to total decomposition which may end in ignition or explosion." The report further explains that ammonia salts exert no dangerous action on such a nitro compound as denitro-benzol, and therefore, why the manufacture of roburite is sanctioned. It also states that the carbonate of ammonia may be mined, presumably because any free acid when formed would at once combine with the ammonia and liberate the carbonic acid, and knowing this reaction a carbonate is probably added in the preparation of acadine.

It will also be noticed in the above excerpt, which is freely quoted by all makers of flameless explosives that do not contain nitroglycerine, that the decomposition *may* end in explosion, and it is assumed the inspectors have reference more especially, if not entirely, to the storage of such compounds, a matter that is not under consideration with us.

PRACTICE.

When experimenting was over and it was found that even blown out shots that were well tamped did not show flame, the new explosives were issued to the colliers, but immediately complaints followed of missed shots, of shots that did but half the work expected of them, and of charges that failed to explode on the detonation of the cap.

Roburite was first in the field in quantity, and the complaint applied to it. The trouble largely arose from the men failing to comply with directions; they would tamp as they had been accustomed to tamp powder, that is from the stemming next the charge, although urged only to press home the first six inches of stemming and told that if the cartridge was rammed hard, not only was there danger of the cap exploding, but that if the roburite was consolidated it would not explode, or would only partly explode and they would lose the charge. With some men the latter often resulted, unless actually under supervision, and the irresistible desire to do so apparently arose from fear that part of the shot would be lost, that the coal would cut where the hard tamping began, and not at the back of the shot. Other men found a difficulty in understanding the difference between warmth and dryness. They would open cartridges unnecessarily long before they were to be used, lean them on the damp pavement, and think they followed the instructions by covering the cartridges in this position over with a coat. Difficulty also resulted from cartridges arriving from the makers in a hard condition, and although men who got them were told to roll them or work them in the hand till soft, still some of these cartridges failed to completely explode and discontent followed. Another source of trouble came from the holes not being properly rounded, cartridges would jam in a cornered hole and when forced back were so cousolidated that the roburite failed to explode. Now these complaints are seldom heard of; the grievances are cost and paying for the paper of the cartridges at roburite price, and having to use a detonator more powerful than that required by acadine.

To date, some 7,300 lbs. have been used and reports of light resulting from explosions of the charges have been few. In some four cases the stuff was set on fire by the detonation of the cap, and burnt without explosion in the hole behind the tamping. In what unusual form the stuff was in the cartridges that so acted has not been made out. Enquiry of the head office in England only brought back a denial of the truth of the statement, but a fact is a fact, however distasteful, and should be met with investigation and not bold denial. The light or glow reported to have been seen in one or two cases, may have come from a "back" in the coal (or, doubtful, from a partial short circuiting of naked wires.) At first men used too much roburite, but with practice some have learned to proportion the consumption to the work to be done, and on an average it appears to be about two and a half times stronger than powder. Roburite has the advantage of not being affected by cold. Its strength has the disadvantage of producing a larger proportion of small coal than powder. It, of course, has the disadvantage in common with acadine and all similar compounds containing ammonium nitrate, of absorbing moisture on exposure to the atmosphere, by which it is first weakened and ultimately prevented from exploding. The cartridges, as usually made, are dipped in paraffin, and so made waterproof, but it has been found desirable to store these explosives in magazines where the air is dried by a steam pipe; at the same time it is probably judicious not to raise the temperature above 90° Fahr.

Acadine, with all compounds containing nitroglycerine, is affected by temperature, and may not explode below 45° Fahr. It can be kept for many hours in a specially prepared can, holding hot water, and so be used in the coldest weather. Cartridges that harden otherwise than from cold have been found efficient, and hard tamping has not reduced the explosive power, but as it also requires a detonator to explode it, it is well not to tamp the first few inches of stemming next the charge. The fumes of nitrous acid that arise from its explosion have been already referred to. In strength it is about fifty per cent. stronger than ordinary powder, and some men find they can work the coal with it better than with roburite. It is cheaper per pound and requires a less expensive detonator. Free option is given the workmen to use which explosive they may prefer, and the quantity consumed to date is some 6,400 lbs.

In one case only has light been seen. A three foot bench, cut on the low side, had a 3′ 6″ hole charged with 12 oz. The shot cracked the coal at the back and along the high side, lifting the bench. The light was shown along the high side.

For the firing of shots no other means than electric fuses have been used, although several devices enabling fuse to be safely employed are known to have been adopted in France. Both magnets, electric and dry cell batteries, are in use; the latter, on account of their lightness, are preferred by the men, but they are comparatively short-lived, rarely firing over 1,000 shots each. The magneto-electric are heavy to carry about in the mine, and when made sufficiently powerful to fire several shots at once, may develop a tension too high for safety. On this point no definite knowledge has been obtained, but with the low tension batteries all experiments have failed to fire a gaseous mixture from the spark they give. For convenience, where several shots are fired in a place each day, a pair of wires a hundred feet in length are left in it, and where the coal is dry, common uncovered telephone iron wire is used and no particular care seems necessary, with low tension batteries, to avoid contact, the dust and scale supplying sufficient insulation.

Complaints arise from imperfections in the detonators causing miss shots at a cost to the miner of about a dollar for loss of time and material; the percentage has been high, nearly one half, but this objection, it is hoped, will be remedied by a more careful selection of the fuses.

SUMMARY.

Powder adds to the dangers of coal mining in pits that are dusty and gaseous. Being an incomplete explosive it rarely does its work in a fall shot without showing light if not flame; it ejects solid matter heated to a high temperature and heated gases capable of combining with the oxygen of the air and igniting fire-damp mixtures and dust, especially in blown out shots. The period of inflammation is of appreciable length.

On the other hand the so-called flameless explosives are complete in themselves; are instantaneous in explosion; generate a temperature below that produced by the detonation of fire-damp, and in explosion rarely show light or flame. When ordinarily tamped, blown out shots fail to show flame; it is, however, suspected that they may show momentary light when fired close to backs or lypes in the coal.

The mixtures recommended by the French Commission were: —

1.	20% dynamite (75 nitroglycerine, 25 silica) + 80 nitrate of ammonium	Coal
	40% dynamite, 60 nitrate	Stone
2.	Blasting gelatine (91.7 + 8.3 mononitric cotton) 12% + 88 nitrate ammonia	Coal
	30% + 70 "	Stone
3.	Octonitric cotton 9.5% + 91.5 nit. am.	Coal
	20%	Stone
4.	Denitro-benzol 10% + 90 nit. am.	Stone

Changes in the Bank at the International Colliery.

MR. J. S. McLENNAN said:—

The International Company has given much care to the preparation of its coal for market, particularly to ship it as free from impurities of all kinds as possible. Size is a quality of importance, particularly in local markets, but less so than freedom from slack and dirt. To this end Rigg's balanced screens were put in some years ago, and the arrangements were fully described and illustrated in a paper contributed by the writer to the Transactions of the Canadian Society of Civil Engineers. These were the best screens available for the length of bank we had, but it was found that a good deal of slack was carried over with the lump coal, the number of men required to pass the output over the screens was large, and the cost high.

It was determined to raise the bank 8½ feet, which would give us 11 feet additional length of screen bars, arranged above the movable screens, and this was carried out, as shown in the accompanying sketches, under the supervision of Mr. John Johnston, the manager at the mines. The coal is deposited from the tumbling cage on the upper part of the bars, where it is retained by a door until the screen is ready to receive it. This door is controlled by a lever brought close to one of the two men on the screens,, and is balanced by a weight not shown in the sketch, so that it is easily opened and shut. It is opened enough to let the coal slide gently down to the lower end of the moving screen, and after it has come to rest it is examined by the men in charge, and when cleaned, if it is found to contain impurities, the screen is released under control of the brake and the coal slides into railway car shown in cross section. Meantime a second tub may be dropped into the screen above the door ready to be let down as soon as the moving section has returned by gravity to its place. We find that the coal is much better screened, as the slower rate at which it comes down allows it to spread out to the full width of the screen and the slack to fall through: but formerly, as discharged from the cage, its tendency was to come down in a mass, carrying with it a considerable quantity of slack, causing either much delay or making an inferior grade of coal. To make run of mine coal the moving screen is covered with plates and the slack box below the fixed part allowed to fill up level with the bars.

To avoid the expense and other disadvantages of raising all of the bank, the working arrangements were entirely altered. The plates which were previously used were taken up, and rails, as shown on the plan, were put down, and carriages to convey the empty tubs across the back of the pit were built. This shortening of the bank floor behind the pit still enables the engineman to have the bank floor in view. It was our intention to move these traversing carriages by balance weights, but it was found that it was so little trouble for the men to use them without assistance that they have not been put in. The substitution of a spring for turning, instead of corner chains on the cages, gave us sufficient height to make it unnecessary to raise the pulley frames as had at first seemed probable.

While the arrangement is not perfect in all its details, it is a great improvement on what we had before—two screens instead of three—and a reduction of one-half in the number of men on the screens is a handsome advantage, and we have in addition the gain of making cleaner coal with less labor to all the men employed.

The capacity of the two screens has not been fully tested; they have, however passed over 100 tons per hour without "scamping" the cleaning.

The writer presents this paper conscious to the full of its lack of importance: but its moral is that a careful exercise of thought in working out details, as was given in this matter by our Mr. Johnston, will often find an inexpensive solution of difficulties, the overcoming of which at the first blush would seem to require a heavy outlay—a moral which, if well founded, is in these days of narrow margins comforting to those who have to do with mining in Nova Scotia, and more especially to those in charge of plants erected for a much smaller output than they now have to deal with.

MR. MCLENNAN—We have done over 1,200 tons run of mine coal in ten hours. The staff of men being reduced from nine to four.

After a vote of thanks to Messrs. Gilpin, Poole and McLennan, the meeting closed.

Dinner.

At eight o'clock the members, to the number of twenty-five, sat down to an excellent dinner in the Halifax hotel. Mr. H. S. Poole, President of the Society, presided. The procedings were entirely *sans ceremonie*. An enjoyable evening was spent in mutual good fellowship.

Safety Catches on Mine Cages.—Mr. C. J. Norwood, Mines Inspector for Kentucky, points out that some difficulty has been experienced in securing the adoption of safety catches for mine cages, only six of the eleven owners at whose mines they were needed, having complied with the law upon the subject. But measures have recently been taken which will doubtless settle the matter in the way required by the State. Four forms of safety devices are used in Kentucky. The one at the Central mine consists of two transverse axes, crossing above the frame of the cage. At either end of each axis is a toothed cam, which acts as the catch, there being, therefore, two catches on each side of the cage so arranged to nearly clasp the wooden guide extending down the side of the shaft. Surrounding each axis is a short coiled spring, one end of which is fastened to a fixed pulley, through which the axis passes. The pulleys and springs are placed about the middle of the axis. Passing around the pulleys, in which one end is fastened, are short chains linked to a single chain, which is fastened to the shackle of the hoisting rope. The tendency of the spring is to rotate the axis so as to close the cams against the guides and coil the short chains around the pulleys. When the cage is raised the strain of the load coils the springs and opens the cams. When the rope breaks the springs, uncoiling, throw the cams against the guides, thus preventing the descent of the cage. The catches being eccentric, the heavier the load on the cage the tighter they grip the guides.

Successful Meeting and Excursion of the General Mining Association of Quebec at Black Lake and Thetford Mines.

On Tuesday, 14th ulto., the members of the General Mining Association of Quebec visited the asbestos mines at Black Lake and Thetford. Leaving Sherbrooke by the 8 a.m. ordinary train, to which a car for the convenience of members was attached, the party, numbering over fifty, arrived at Thetford a few minutes before eleven. Here they were met by the local committee. A visit was first made to the excellent property of the Beaver Asbestos Company, and an inspection made of the workings. The company has some fine shows of the mineral and is well equipped with an economic plant, including travelling and cable derricks, steam drills, 30 h.p. boiler, pumps, etc. While in the big pit Mr. Lainson Wills photographed the party. The productive mines of the Ward Bros., A. H Murphy, and the Johnsons Company were visited in turn, although the inspection of the latter was abruptly shortened by a heavy thunderstorm which quickly drove the visitors under shelter. At 1 o'clock an excellent luncheon was served in the store house of the Bells Company. Here a surprise was in store. Ordinarily a bare and unpretentious building, the shed, by dint of the skilful application of evergreens and a profuse application of national flags and bunting, was found completely transformed into a tastefully decorated and well-equipped dining room. Too much praise cannot be given Mr. George R. Smith, the genial superintendent of the Bells Company, for his indefatigable efforts in this work. Mr. L. A. Klein, Engineer of the American Asbestos Company, in concert with Mr. Smith, made a great hit here in the role of bar-tenders and caterers. After ample justice had been done to an excellent bill of fare, the chairman, Mr. D. A. Brown, in a speech, characteristic for its point and brevity, bade the Association hearty welcome, to which Capt. R. C. Adams suitably replied. Lunch over, the members divided into parties and spent a pleasant afternoon inspecting the mines and works of the Bells Company and King Bros. These two concerns are the largest producers of crude asbestos probably in the world, and much interest was therefore taken in the various processes adopted for mining, cobbing and fibreizing the mineral preparatory to its export abroad. En route to the train a pleasant half hour was spent enjoying the well-known hospitality of Mr. William King. Much pleased with their outing and the many kindnesses showered upon them by the good people of Thetford, the members left on their car for Black Lake, arriving at the Club House shortly after four o'clock. Here a number of teams were provided and parties were driven to the mines of the Anglo-Canadian, Glasgow and Montreal, American Asbestos and other companies operating in the neighbourhood.

The Meeting.

At half-past five o'clock the members assembled in the cosey Club House. Among those present were Capt. R. C. Adams, Anglo-Canadian Phosphate Co., Montreal; J. Lainson Wills, F.C.S., Ottawa; A. W. Stevenson, C.A., Montreal; C. Circkel, Templeton Asbestos Co., Templeton, Que.; W. E. Bell, Toronto; J. Burley Smith, M.E., Anglo-Continental Guano Co., Glen Almond, Que.; R. T. Hopper, Anglo-Canadian Asbestos Co., Montreal; A. M. Evans, M.E., King Bros., Thetford; Col. Lucke and Mr. James S. Mitchell, Beaver Asbestos Co., Sherbrooke; John J. Penhale, United Asbestos Co., Black Lake; Capt. Matthew Penhale, Glasgow and Montreal Asbestos Co., Black Lake; D. A. Brown, Boston; Mr. Erbhart, Sec.-Treas. H. W. Johns Asbestos Co., New York; Geo. R. Smith, Bell's Asbestos Co., Thetford; Mr. William King (King Bros.), Thetford; L. A. Klein American Asbestos Co., Black Lake; B. T. Kirkhouse, Montreal; F. A. Halsey, Canadian Rand Drill Co., Sherbrooke, Que.; B. T. A. Bell, Editor of the CANADIAN MINING REVIEW, Ottawa, and others. In the unavoidable absence of the president, Capt. Robert C. Adams took the chair. The Minutes and Reports of Council were presented and confirmed.

The Visit of the American Institute.

The Secretary read the following correspondence:—

NEW YORK CITY, June 4, 1892.

B. T. A. Bell,
Ottawa, Canada.

DEAR SIR,—The Council of the Institute has voted that the annual meeting, beginning Feby. 21, 1893, be held in Montreal, provided of course, that our Canada friends find it practicable to carry out their proposed arrangements, and that they confirm the preliminary invitation sent by way of inquiry.

This decision has not been publicly announced, and you need feel no embarrassment in notifying me of any change in the situation rendering the withdrawal of the invitation desirable, or rather, of any change, which, if you had known of it before, would have led you to postpone your plan.

If, however, you should be able to advise me before June 28, that your arrangements had been successfully completed, so that the meeting could be announced with reasonable certainty, it might be pleasant to speak of it at the Plattsburgh meeting. I shall probably not be at this office later than June 24. After the 23rd, therefore, you had better address me at Hotel Champlain, Bluff Point, N.Y.

Yours truly,
R. W. RAYMOND,
Secretary.

McGILL UNIVERSITY,
MONTREAL, June 9, 1892.

DEAR MR. BELL,—In reply to your favour of the 6th inst., I have no hesitation in saying that the University will be glad to do all in its power in aid of the proposed meeting of Mining Engineers. The details would have to be discussed later, and will be modified by the fact that the time mentioned is in the College Session, and that our classes would be going on during the time of the meeting. This, while it would limit our available space, might be an advantage in other respects.

Truly yours,
J. WM. DAWSON.

After some discussion, it was resolved, on the motion of Mr. D. A. Brown, seconded by Mr. Wills, to leave the details of a convention in the hands of the Council, to report at the next quarterly meeting of the Association.

The following papers were then read:—

The Labor Question in its Relation to Canadian Mining.

By J. BURLEY SMITH, M.E., Glen Almond, Que.

MR. PRESIDENT AND GENTLEMEN:—

In taking up this question as the subject of the paper I have the honor to read before you to-day, I find that however important and interesting it may appear to my view of the position, it is an extremely difficult and complex matter to condense within the limits of such a short paper as this must necessarily be.

It is at the same time a delicate subject to handle before an Association like this, on account of the social and political questions involved which cannot be ignored in dealing with it either as an abstract problem or from the standpoint of employers who are pecuniarily interested in the employment of labor.

But it will not be forgotten that we have associated ourselves together, not merely to protect our interests as a trade organization, but with the higher motive of mutual improvement.

The labor question is one which employers always hesitate to discuss publicly—partly, perhaps, because there is a half consciousness that we have not been quite guiltless in our dealings with labor, and that free discussion might stir up our inner consciousness to a higher sense of duty and impel us to a line of conduct inimical to our self-interest.

A serious point for our consideration is the scarcity of good miners in Canada, even in the present extremely depressed state of mining industries of all kinds: and there can be no question that in spite of the efforts of the Government to encourage emigration from the older countries there is always a scarcity of labor; and it is strange that in spite of the great number of emigrants coming into the country all the time this scarcity should exist. It is stranger still to observe the curious exodus of labor which is going on constantly from Canada to the United States.

I have noticed that during the last two or three years that whatever may be the state of our industry, whether active or depressed, there is always the same difficulty in keeping up a complement of efficient miners, and it has been found necessary to increase the number constantly by the use of agricultural labor.

It would therefore appear that the ranks of the miners are being constantly and regularly recruited from the farmsteads, to whose sons the activity and change from a hum-drum monotonous life offers an attractive charm.

There would be nothing especially remarkable in this, as it occurs in all countries, still it is always injurious to the general prosperity of a country and shows there is something economically wrong when the laborers leave the cultivation of the soil in too large a proportion; and it is a very serious thing indeed in a new country when these men, having deserted the land for the mines, got some knowledge of mining and accumulated a sufficient sum of money to travel with, leave the mining field of their own country for that of a neighboring and richer one from which they seldom return.

In older countries the occasional depressions in mining are always accompanied by the inevitable distress of the unemployed, who do not, however, necessarily leave the district or country, except in the case of those who are induced or assisted to emigrate, either by the too often specious promises of the emigration agent or the pecuniary assistance of well-meaning, though perhaps mistaken philanthropists.

There can, however, be no two opinions as to the value of this surplus labor as emigrants to a new country like Canada, with her vast undeveloped resources, and there is every excuse to be made for the large expenditure incurred yearly for this purpose, providing that this imported labor remains in the country, and does not, as is too often the case, make this a halting place only and pass on to the neighboring United States, ever ready to receive them, even though at Canada's expense.

Here, in times of depression, one does not see this army of unemployed and the palpable distress accompanying it, and though the storekeepers and tradesmen of the affected districts complain of and undoubtedly feel the bad times, it is not analagous to that of old countries, or even that of the United States, and it would seem, therefore, as if this draining off of the population to the United States was a silent yet steady exodus (unnoticed except for the continual bankruptcies of storekeepers and the figures of the census returns) which, in spite of the enormous importation of foreign labor, tends always to keep down the population and natural increase of the national wealth.

Though the mineral wealth of the Dominion is magnificent and the efforts of speculators to boom and develop it unremitting, the industry cannot by any means be considered flourishing.

It is, however, within the bounds of possibility that the rapid discoveries and inventions in the industrial arts of modern times, may, in the near future, create a new and sudden use and demand for mineral products, and a period of unexampled activity and prosperity come to us, and in such an event we may be quite sure that the labor question would be a very serious one to consider at that moment, and it is quite certain there would be great difficulty in getting a sufficient number of efficient miners to work and enable mine owners to take full advantage of it.

Such mining activity would not necessarily mean a rush of labor to the scene of it. It is only in the event of the sudden discovery of fabulous finds of the precious metals that a rush is made by all kinds of men, who, however, do not swarm there with a view of finding work so much as of participating in the general luck. One never hears of an asbestos, coal, copper or phosphate rush. We do certainly hear of a boom sometimes, but that does not attract any considerable number of men who are over-anxious to labor.

The labor question before us is an economic one, and can only be determined by the conditions which affect all wage labor, whether miners or weavers, and it is from this point of view that we employers have to look at it.

Granted that there is a scarcity of miners in the proper sense of the term, and that this scarcity would be felt still more in the event of the prosperity we are anticipating, and granting that there is a constant shifting or moving on of the population to the neighboring country, it remains for us to consider the cause of this state of things in order better to find a remedy. And it is a matter worthy the consideration of all patriotic Canadians, because no greater calamity could happen to a new country requiring all her population for her own welfare and prosperity, than for her people to find that they can be individually more prosperous and happy in an adjoining country than in their own.

Primarily it must be admitted that the great attraction for Canadian miners in the United States is the higher rate of wages; and although it can be shown that this does not necessarily mean a greater acquisition of wealth to the recipient, because the well known conditions of wage labor, which have been reduced to a formula known as the "*Iron Law of Wages*," proves that wages, however high, are never much above the cost of maintenance. Still they are higher there than here, and have the attraction of the higher figure to those who cannot naturally be expected to look at it from an economic point of view. To a single man, having only himself to provide for, it appears a great advantage, for he is able to save or spend, according to his proclivities, the balance in excess of his necessities. But to the people in the aggregate it is not, because the married family man does not receive any more wages than the single man, though he has much more to pay out of it.

The wages in Great Britain are considerably less than in the United States, yet the work people enjoy the same amount of comfort—that is to say, their wages buy nearly as much as they actually need.

The thrift and economy of a people collectively does not necessarily mean an increase of wealth, though individually it may raise one's personal condition above the rest of the community.

The higher figures of the United States do undoubtedly attract Canadian miners as well as laborers of all kinds. The rate of wages is pretty nearly the same, or likely at any time to become so in all the States, because although they have a policy of protection on the common frontier they enjoy absolute free trade amongst themselves. Canada, adjoining a number of these States, cannot alter the conditions of her labor market to suit this order of things, and cannot, therefore, prevent the exodus of her people by offering the same high wages, because her labor market is ruled by her own politico-economic conditions, which are different to those of the United States.

The rate of wages in the United States is higher than it is in Great Britain because of the former's policy of protection, which imposes a duty on imported goods, with the result that the consumer pays the productive cost of these goods in unprotected or free-trade countries, plus the duty imposed, and a little more. This increased

price increases the cost of his maintenance and raises his wages to meet this, and no more.

The rate of wages is higher in Canada than in Great Britain, and lower than in the United States, because her geographical position will not allow her under present conditions to have the same measure of protection as the United States, or the same measure of free trade as Great Britain, the rate of her wages being subject to the same economic laws which govern the cost of production everywhere. At the same time it must be borne in mind that these economic or natural conditions are at all times liable to be interrupted by the misgovernment of a nation, by bad laws, by unfair taxation, by wanton waste of public treasure, by peculation and the sacrifice of the commonweal to the private interests of those who are elected by the people to represent them in her councils. This is the political situation, and is dangerous ground.

The social view of the position perhaps touches us more intimately, as we must be more or less familiar with the social life of those laborers we employ in our mines, and as far as my knowledge and experience go I cannot help thinking that our disregard of the personal comfort and social wants of our miners has had not a little share in causing the exodus of this class of labor.

The housing of the men and the food supplied to them have not been as creditable to us as such matters should be, and savors not a little of the iniquitous "truck and Tommy" system of the old countries of fifty years ago, happily now a thing of the past.

It would appear as if our method of barracking and feeding the men had been copied from the lumbermen's shanties in the backwoods, for which there may have been some excuse, considering their extreme isolation and the difficulty of getting supplies. But the system is not well adapted to mining settlements, which, from economical reasons of transport, are never very far away from civilization and means of communication with the rest of the world.

The system common in mines—of paying wages and board and deducting an arbitrary sum from the former to pay the latter—is not a just dealing, and leaves too many openings for peculation on the part of managers, bosses and board masters, and does not leave the workman free to economise his earnings to the best advantage, and can only be designated as "taking it out" of the men.

The plan of barracking and boarding the men tends also to make the miners roving and shifty as a class, and careless and disinclined to settle; and I cannot help thinking that if more cottages were built by mine owners, or land given for miners to build cottages around the works for themselves, we should have a much more stable and settled mining population. The men would marry and become domesticated; they would cultivate gardens and perhaps small farms, and thus have other leisure occupations than horse-play and cards and the inevitable quickstep and fiddle. Population would increase and there would always be an hereditary race of miners springing up. It is superfluous to remind you how beneficial this would be to a mining country. It is hard to pass this subject without paying a deserved tribute of praise to the owners and managers of the mines we have visited to-day, for whilst passing through the mining settlements of Thetford and Black Lake, with their neat and pretty cottages and the unmistakable signs of general comfort and happiness, it was impossible not to feel that the asbestos region had already realized what some might consider a dream of Eutopia. I regret to say that this is not the case in all the mining districts of Quebec.

If a mining population could be established on a more settled basis, schools—the great want of which is most seriously felt in the neighborhood of many mines—would be established as a matter of course, with enormous advantage to the risng generation.

Canada, with her boasted educational system, seems to neglect the miners and outlying districts altogether. In our district some time ago I made out a list of over thirty families with grown up sons and daughters who were unable to read or write; and this evil is more disgraceful from the fact that in many instances the parents could both read and write. On our side of the river Lièvre the nearest school is five miles away, the road to which is impassable in winter.

The custom common in so many mining districts of Canada, of closing down mines in winter, cannot be defended. It has the effect of practically leaving the miners six months out of work during the year. This alone must have the effect of driving them to seek more permanent and regular employment elsewhere. It is a bad system altogether, for while the workmen drift away to other parts the capital of the employers invested in plant and machinery, to say nothing of that expended in opening out and developing the mine, is lying idle and unproductive during this period, and though the works are stopped there are certain fixed charges which go on all the same. There is, moreover, really no necessity for it, if the mining is carried on scientifically and on correct principles, because nearly all mines—I do not refer to quarries—can be worked more economically by subterraneous excavation than by open cast, the latter being ill-adapted for such a climate as that of Canada, with her deep snows and severe frosts. With a proper system of underground working there is nothing to prevent mining operations being carried on all the year round to the greater advantage of both owners and laborers.

It is quite evident that if miners have to earn enough wages in six months of work to support them for the remaining six months of enforced idleness they will require a higher rate of wages for the period they are able to work. The fact of miners getting so heavily into debt as they do with the storekeepers of the neighboring villages proves the economic truth of this. I am sure all of us are familiar with the regular visits of the bailiff with his writs of seizure on the miners' wages for old debts, most of which, I find on enquiry, have been incurred during the unemployed winter time. And it may not be out of place here to express my heartfelt opinion that nothing could be more unfair to the working men of our Province than this harsh law of seizure for petty debts. A man incurs a debt for the necessaries of life, say during the unemployed time of winter: this is allowed to run on; interest accumulates; the creditor obtains judgment against him; costs are added to costs, until shortly the unfortunate debtor finds himself saddled with a debt of twice the original amount, and with diminished power of paying it, and a seizure is made, not merely on part, but the whole of the wages coming to him. The employer is appointed garnishee and is himself held responsible if he fails to pay over the man's wages to the court, and thus finds himself a party to a transaction of which he is ashamed. On enquiry he finds that only one-fourth of the amount due to the man can be legally taken; but to carry this out he has to attend the court to make a declaration as to this amount, which entitles him to his expenses if he chooses to claim it. Further costs are thus added in various ways to the burden already too heavy for the debtor, and he usually finds that hard as it is, it is better to pay the whole of his wages, even though his wife and family have to starve or incur fresh debts, or "skip." Can it be wondered at that there is an exodus? Is it credible that these men have votes, that they send representatives to Parliament, without asking for the repeal of such laws?

After these remarks I think you will agree that the labor question is one of the deepest importance to the industry we represent, and that the miners, *i.e.*, the producers of mineral wealth, are unavoidably involved in the question of successful mining, and that it is incumbent on us as an Association to care for the welfare of our miners from motives both of policy and duty.

It behoves us to enquire into the political view of the question and to use the strength of our organization in effecting such constitutional reforms as are desirable for bettering the condition of our miners in order that they may not be driven out, but remain to develop the mineral resources of Canada, and especially our Province.

It behoves us to look to ourselves and see that the social welfare of our miners is not neglected. And bear in mind, gentlemen, that Canadian miners, taken as crude material, are as fine a class of men as can be found anywhere, and that our neighbors in the United States are well aware of it, and are—so much the worse for us—always ready to welcome and employ Canadian mining labor and pay more for it.

The Canadian Asbestos Industry.

By L. A. Klein, M.E., Black Lake, Que.

The asbestos industry of Canada has assumed a rank which makes it well worth while to study how to further develop the same, and many have turned their eyes towards our Province and its serpentine regions: Governments, capitalists, mining men, speculators, prospectors and so on—all have contributed in their own way to this purpose.

Many things have been said and written on asbestos, asbestos formation, asbestos industry, asbestos uses and markets, and it is certainly not the lack of talk on the subject which has induced me to take it up for this paper. I have been led to do so in consideration of the facts that by former writers on the subject a good many practical points have not been touched—points which must be of special interest to those who are about to interest themselves in the industry, be it with money, be it with actual work—but also in consideration of the fact that amongst those not intimately connected with the industry, opinions of an altogether erroneous nature as to the value and character of the industry are spread about, which may occasionally lead to a very inconvenient disappointment. There are even a good many things amongst us mining men out here on which the difference of opinion has not as yet reached a settlement, as it is naturally with an industry in sueh a young state as ours.

I have tried to get the co-operation of all my fellow miners in the industry to make my statements as complete as possible, and I tender my heartiest thanks to those who have complied with my request. I must, however, add that the opinions expressed in this paper are individual and under no other authority than that of my own observations and my own judgment.

I had still another object in delivering this paper, and that is to show the asbestos industry in Canada from a national and economic point of view, or in other words, to look at it as a whole and a resource for our Province and the Dominion of Canada, respectively.

You have to-day looked over the asbestos mines in Thetford and Black Lake, and while the time has been very limited and no chance whatever could be given to follow up a special line of the business in which we are engaged, you have, however had an opportunity to see in general the mode of occurrence and production of asbestos. While you have done so you have seen the area which I may safely say produces about 85% of all the asbestos used in the world.

Serpentine covers quite a large area in Canada and especially in the eastern townships of Quebec. It is not my object to-day to describe its extent, which has been done in an exhaustive way as well by members of the Geological Survey as by the authorities of our Provincial Government, but I will confine myself to those districts which have as yet received prominency and which practically supply the demand of the world. These are, in the districts of Thetford and Black Lake, with some more or less encouraging developments to the north and south; the district of Danville, with, so far, one prominent mine in the production of asbestos; and the Templeton district, in which, however, the industry has not yet assumed more than an exploratory character.

If you compare these very limited areas representing the region of the big serpentine belt which produces asbestos in a quantity and quality which will, economically worked, yield a profit to the investor, with the comparatively enormous extent of serpentine rock, you will readily come to the conclusion that it takes more than the finding of the serpentine to have a paying asbestos mine, and that is one point I would like to pick out and submit to your consideration.

While the undoubted success of some of the existing mines, in combination with erroneous ideas on the formation, occurrence and of production and so on, nursed by speculators, lead many to believe that they struck a fortune when a locality was shown to them which contained serpentine of a very good or just the right color, with occasionally a small asbestos seam in it; and while many have been induced to spend a considerable amount of money under these false impressions, I may state that not one enterprise has proved successful in this industry which has not had anything else to look on than serpentine of a good color. All those successful mines had as surface indications asbestos in good and large veins of real commercial value, and I do not hesitate to say in some cases larger veins than they can get to-day. We may be unable to declare a locality worthless as an asbestos mine, judging from color and sections of serpentine, but I am certain that neither I, nor any of my confreres who have devoted some of their time to the study of the subject would commit ourselves in recommending a locality as an asbestos mine from the good look of the serpentine, without having seen besides really valuable and marketable asbestos veins in sufficient quantity, and this notwithstanding the expression of one of our scientific authorities that the rock likely to prove asbestos-producing can be determined by certain peculiarities of texture, color or weathering.

I will not take up your time with a detailed description of the mineral, but merely make a very few general remarks.

Asbestos is a fibrous variety of serpentine, and is, chemically speaking, a hydrous silicate of magnesia. From several analyses of a number of specimens all over the world, which I had at my disposal, the percentage of silica is from a little over 40 to 40½%, while magnesia is from 41½ to 43%; other more prominent admixtures were ferrous-oxide and alumina in quantities of from 1 to 3%, and further, traces of lime, potash, soda, chlorine and sulphuric acid. This composition is completed by water, to which we have to attach the most importance from a business point of view. This, of course, is not water in the form of a moisture, but water intimately associated with the silicate of magnesia. The importance of this water has been shown by the fact that good and fine asbestos fibre, may it be from the Italian variety or from the Cambrian rocks of the Eastern Townships, or the Laurentians from the north of the St. Lawrenre, contains from 13½ to 14% of this water, while some very harsh and brittle specimens of asbestos have shown considerably below 12%. Experiments have further shown that it is comparatively easy to dissociate a part of this water from a fine and silky specimen of asbestos fibre and to render the same hard and brittle by heating it to a certain extent. This peculiarity leaves us to conclude why we find such considerable differences in the qualities of asbestos in comparatively close proximity, as, for instance, the larger percentage of "thirds" in Black Lake than in Thetford; and then even at the best mines, qualities of no, or very little, commercial value. The asbestos in these localities has been rendered harder by the influence of heat through the intrusion of heated matter, following the original formation of it, and this heated matter has been the masses of granulite which we find throughout our serpentine region, with the exception of a small knoll of serpentine in Thetford, where granulite appears only in very small dykes. And here is another point where I differ from some of our fraternity who hold that the presence of these masses of granulite are a good indication of asbestos—a theory which I think can scarcely be maintained, at least, however, as to asbestos of commercial value, in the close neighborhood of these masses of granulite.

Thirteen incorporated companies, with an authorized capital of about three and one-half millions of dollars, of which a part, however, is employed in the manufacturing business in England, with a number of very prominent private concerns, occupy themselves to-day with the production of asbestos and asbestos mining, and I believe that my estimate that about two and one-quarter millions of dollars are invested in the industry in Canada comes very close to the reality.

While until about four or five years ago, with one single exception, hand work, occasionally connected with horse-power hoisting, was exclusively used in asbestos mining, the leading mines are now equipped with more or less extensive plants of machinery to carry on the work.

This work consists,

Firstly—Of the proper mining operations, such as the drilling, blasting, removing of the broken rock out of the pits to the dumps, hand in hand with the gathering up of the asbestos veins and transport of same to the dressing establishments or cobbing sheds.

SUPPLEMENT TO THE CANADIAN MINING REVIEW.
JULY 1892.

The June Excursion Meeting of the General Mining Association of the Province of Quebec, at Black Lake and Thetford Mines, Que.

ARRIVAL AT THETFORD MINES.

AT KING BRO'S MINES.

IN THE BEAVER PIT.

GROUP AT THE JOHNSON'S MINE.

CAPT. ADAMS. J. BURLEY SMITH. A. W. STEVENSON.

GROUP AT THE BELL MINE.

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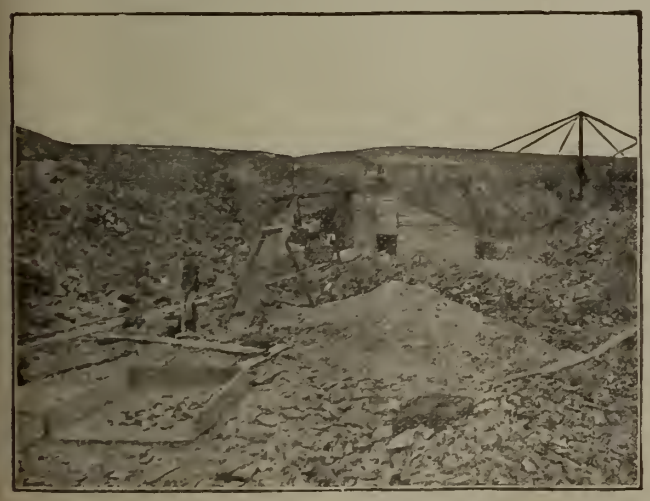
Secondly—The dressing or cobbing, that is, the separating of the asbestos fibre from the adhering rock and the grading of the former in different qualities, followed by packing, transport to railroad, loading, shipping and marketing. It may not be unwise to review these different operations shortly, as the circumstances under which asbestos is produced are entirely different from nearly any other mineral or ore, and we find nearly every item which we were used to consider as a thoroughly established rule greatly changed by these circumstances.

This is readier understood when we consider the large

amount of rock which has to be handled in comparison to the ore, the peculiar nature of this rock, the character of the ore, which is a fine silky fibre, and must be carefully protected from injury and so on.

As to the drilling, hand drilling is still in exercise in all the newly opened mines for prospecting work, and even in one or the other of these mines which have already reached considerable prominency. It is further nearly exclusively used for block-holing—only very recently one of the mines has introduced a small size machine drill for the purpose. It is done by three men with 1 inch octagon steel, and 6 to 7 lb. hammers. The average capacity is about 15 to 16 ft. a day of 10 hours, and the cost about 20c. per ft. The depth of holes is thus seldom exceeding 4 ft. Some of the mines have not long ago adopted a plan of block-holing with one man only, using ¾ inch steel, and 3 to 4 lbs. short-handled hammer. The capacity is thus about 8 feet for 10 hours' work and the cost only about 14 cents.

Most of the mines do their drilling, however, with steam or compressed air, 45 ft. per day of 10 hours in the former case, and from 50 to 55 feet in the latter being considered a fair day's work. The expense per foot may be set, considering the present prices for fuel, at from 7 to 8c. per foot, not including wear and tear on machinery and interest for capital involved in the buying of the necessary machinery. There are in all 7 compressors with a total of 44 drills capacity in use, 4 of them being built by the Rand Drill Company, 2 by the Ingersoll Rock Drill Company, and 1 by the Norwalk people. At present also, 44 steam drills are employed in the industry, of which, however, 11 are run by steam. About one half of all drills in use are Rand's Little Giant No. 3, 3 Rand Sluggers,



5 Ingersoll 3 inch, and 12 Sergeant's—a couple or so being of other manufacture. The steel in use is 1¼ octagon and costs in the neighbourhood of 10c. a pound. As a rule the drills are worked under 80 lbs. pressure to square inch. We may consider an expense of 3½ cents to the ton of broken rock as the average cost at present.

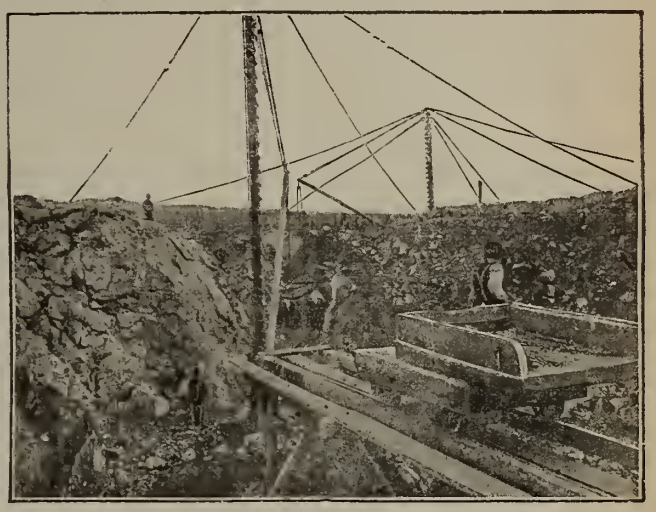
The blasting is now generally done with dualin, which contains about 35% of nitroglycerine, of which the cost is at present 20c. per lb., but which prices will be very likely further reduced through the competition of a newly erected powder factory in the district. With all of the larger mines the blasting is done by electricity; still there are some which hold to the system of one hole blasts, claiming that by this system less of the asbestos veins are smashed to small particles and scattered all over the place, therefore involving more expense to pick them up. The expense for explosives is about 3 cents to the ton of rock broken.

The next operation is the removing of the broken rock from the pits to the dumps with which the picking up of all the asbestos veins goes hand in hand. If the bottom of the pits are on the same level with the top of the dumps, the operation is simply to load the refuse rock on trucks, stone-boards, wheelbarrows, etc., and bring it by one or the other of these means to the dumps; where this is not the case, as in most of the more extensively worked mines, where pits vary in depth from about 30 to 150 feet, the rock has to be hoisted up by means of derricks. At the disposal of this industry there are at the time about 75 derricks, of which, in two cases hand, and in twelve or thirteen cases horse power is applied as motor, the rest being steam derricks. Hand and horse derricks have of course only a right to exist where there is a comparatively small amount of rock to be handled and where the works are of a more or less exploring character only, and the first expenses of putting in steam plant seems unadvisable. The steam derricks are to be distinguished in two classes, boom and cable derricks; from the latter class only two being so far in use. Boom derricks consist of a mast held by means of guys in a vertical position and turnable on its own axle, while to the foot of the mast a boom or arm is attached and suspended in a more or less horizontal position by means of ropes stretching from end of mast to end of boom. The length of the latter is generally from 40 to 50 feet, and it is clear that the working space of such a boom is limited by its length and can ,eeonomieally, hardly be extended to more than say 50 feet.

The cable derrieks have a mast somewhat similar to the former, but instead of a boom, a cable with a traveller on it, which cable is stretched from top of mast to some point across the pit, allowing by means of the traveller, to hoist from any point of the cable. As this may be stretched to a length of 400 and more feet the enormous advantage over boom derricks seems clear, and I have no doubt that its general introduction is only a question of time. The ropes used for hoisting are ⅝ to ¾ in. crucible cast steel, the guy ropes generally ⅞ of an inch; the cables 1½ or 2" steel ropes.

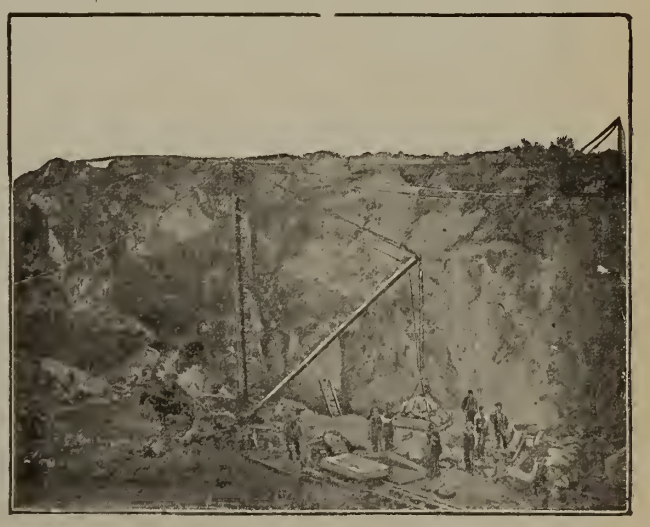
There are eighteen double and twenty-four single drum hoisting and winding engines employed in the industry, or a total of sixty drums. The so hoisted refuse rock is placed on lorries and wheeled out on the dumps either by hand, or, where the dumps are somewhat long, by horses, and there discharged. In some of the mines, to a great advantage, self-dumping cars of a very simple construction are being used. While now nearly all the larger mines use iron or steel rails, and lately, specially of the lighter sort, (19 lbs. Canadian make, at a price of $40 per ton delivered), there are still some wooden rails with band iron top in use, which practice, however, with the growth of the industry, will have to be soon abandoned.

The transport of the crude asbestos to the dressing or cobbing sheds is in most cases done by the simple means of a cart and a horse, or where sheds of a more or less provisional character are placed right on the edge of the pits, carried in by hand. Where the cobbing is more concentrated in a special and permanent establishment we find rail connection for the purpose. Two of the mines, however, have a more or less systematic handling of the stuff in this state—consisting of iron self-dumping skips, which are loaded directly from the pits, hence they proceed down an inclined railroad and discharge their



loads directly in the cobbing establishment. The skips are brought back by means of winding engines. The cost of the above-described operations, viz: Removing of refuse rock, hoisting, picking of asbestos and its transport to sheds, are of course somewhat influenced by the size of the veins in the respective bed rock, the heights and accessibility of the pit's face, lengths of dumps, and so on, but may with fair certainty be set at 22 cents per ton of rock handled in summer time, which figures unfortunately increase in winter time, in some cases to 35 cents, and may be accepted with 25 cents for all year round work.

The second part of the operation at the asbestos mine is the dressing, or commonly called cobbing, which comprises the freeing of the asbestos veins from rock as much as possible, (the crude asbestos in the market still contains from 15% to 40% of rock, some manufacturers even claim more than that while they are negotiating new contracts), and the grading in two, three or four different grades. This operation is as a rule done by hand by little boys, with the aid of a hammer weighing about 1½ lbs. Some of the mines, however, have partially or entirely adopted the aid of machinery, and this more particularly for the transformation of the so-called cobbing stones—*i.e.*, larger pieces of rock with a more or less valuable asbestos vein in it, a vein, however, which did not give away from the blast, and which requires the breaking away of the adhering rock by means of powerful blows, (sledge hammers), or compression, (crushers). The first to try and solve the problem was the Scottish Canadian Asbestos Co. Unfortunately the development of the process sustained a sudden interruption



by the closing of the mines in the autumn of 1888. Their plant consists of a 50 h.p. engine, Blake rock breaker, travelling picking tables, set of Cornish rolls, revolving screens, elevators, shakers, two large blowers, and so forth. Next the American Asbestos Co. started in to experiment in the winter of 1890-91. The main object then was to do away with the somewhat indistinguishable grade of No. 2, an object, however, which was difficult to reach, unless the fibre could have been thoroughly loosened and freed from stone. Their plant consisted in the main of a Blake crusher, to which the crude asbestos is conveyed by an in-

clined railway, and automatically dumped in front of the crusher. The jaws of the crusher are set at 1½ inches, the crushed stuff drops on an inclined sieve in shaking motion, which separates all the loose fibre and the dust from the larger pieces of rock and asbestos veins, the former going directly to the cleaning or grading machines, the latter dropping on a revolving picking table, where the barren rock is removed by hand to one side of the table, the asbestos veins being left on the other. At the end of the table is a receiving chute which is divided into two compartments, and into which rock and asbestos are discharged respectively. The rock drops from the chute directly into a lorry and is wheeled to the dumps, while the asbestos is conveyed either to the dry kilns, as necessary in winter time or rainy weather, or to the fine crushers for further manipulation. These latter are of unique construction, of which the object is to allow particles of a certain size and loosened fibre to go through, without being further crushed, as thereby the asbestos fibre is likely to be injured. This so reduced stuff is brought to the cleaning and grading machines, consisting mainly of a set of inclined sieves in rapid shaking motion in connection with blowers, fans, etc.—remaining unbroken stone and unloosened fibre going back to a set of still finer crushers to undergo the process again. The plant at King Bros. mines in Thetford, which was principallyerected for the extraction of asbestos out of large pieces of rocks on the old dumps works—which some years ago did not warrant the expenses for block-holing and further handling—consists of a Blake crusher, from which the stuff is conveyed on a set of Cornish rolls with the intention of having all stone reduced to powder—from there to a revolving screen of which the object was to screen out all the dust and leave the clean fibre. This object, however, has not been fully realized, owing to the failure of the rolls to break up the rock entirely, and an additional blowing and screening plant has been put in, which produces now a very clean product of one grade. The Anglo-Canadian also runs a crusher and a set of sieves, and the Johnson's Co. has recently put in a couple of crushers to overwork the old dumps. None of the processes at their present state, however, may as yet be considered complete, the main difficulties being two :—

1. That, if asbestos is crushed with a considerable amount of stone together until the latter is reduced to powder—the long and most valuable asbestos fibre is partially destroyed.

2. If the stone is not entirely reduced before grading it is nearly impossible to free the fibre from the stone, and a large amount of waste is the result.

Besides, development of this part of the industry has to stand other very trying circumstances, as the objections of a good many of the manufacturers to buy prepared fibre; the trouble with the customs, which is rather inclined to classify the so prepared asbestos as manufactured, and to levy a duty of 25% of value on same, and the considerable amount of low grade waste which is found very hard to dispose of.

The cost of cobbing varies, of course, considerably, according to the quality of material. While some stuff will break from the stone very easy, other requires considerable labor; then larger veins will sooner be gathered than small ones, and while some stuff occasionally may be contracted at $3 per ton (this, however, never includes the manipulation of cobbing stones), others may cost as high as $15 or $18 and more dollars per ton. I believe that, including the breaking of the cobbing stones, $7 is the average cost of cobbing of asbestos for a ton at the leading mines of this section.

The stuff after being graded, which is, however, in the entire discretion of every particular mine, (prices of some number 2 and number 3 last year differed about 400%), is put in bags of 100 lbs. each. Cost of bags are from 5 to 6 cents each, cost of bagging, 20 to 25 cents per ton. The cost for transport to cars and loading on this section vary from 10 to 60 cents a ton, according to distance from railroad.

To complete this part of my statement I may add that in this industry there are 40 boilers with a capacity of 1825 horse power, and about 2,000 men employed. The value of plant, that is, machinery, buildings for stores and dwelling purposes, water reservoirs, roads, etc., is estimated at $355,000.

If I try to give now in the following an idea about the cost of asbestos mining it must be understood that it cannot be applied to any individual mine. The cost of every one will naturally depend in first line upon the quality of the ground the mine is on, and upon how near the respective mine comes to the average with regard to purchase price, invested capital or plant, expenses of management, and so on. As to the quality of ground I have, therefore, chosen to calculate the expenses on the ton of rock, and the cost of asbestos production will depend upon how many tons of rock in a certain mine have to be removed in order to produce one ton of asbestos. On this subject the opinions of the asbestos miners are considerably different, and while some claim to mine only on 50 or so tons of rock to the ton of asbestos, others go as high as 150. I am of the opinion that as a rule the quantity of rock mined to the ton of asbestos is greatly underestimated. Basing, on the capacity and actual work of our machinery appliances, the known quantity of lorry loads removed from a mine during a year, and the known average weight of each load, in relation to the totals of asbestos produced, I hold that 1 ton of asbestos to 100 tons of rock is a fair average. If we accept this the cost of production of asbestos may be set down as follows: drilling, 3½ cents; blasting, 3 cents; labor for removing rock and gathering asbestos in the pits, 25 cents, making a total of 31½ cents to the ton of rock, or $31.50 to the ton of asbestos; $7 for cobbing; $1.50 for bags and bagging; 50 cents for loading; $5.50 for supplies that includes fuel, tools, iron, steel, timber, other materials and repairs; $6 for general business expenses, such as management, insurance, offices, marketing and others; $3.75, 10% wear and tear, calculated on a total of $355,000 in plant and 9,000 tons production, making a total of $55.75 to produce one ton of asbestos. If we calculate now that we have to pay interest on a total invested capital of about two and one-quarter millions of dollars, for which at least 10% must be expected, we have in our sales to average a price of at least $80 per ton of asbestos. Relating to the totals of production for the last eleven years, the figures at my disposal show for 1891 an output of nearly 9,000 tons, with a value of about $1,000,000, thereby ranking third or fourth as far as value of mineral production in the Dominion of Canada goes, being exceeded only by the coal production, valued at about seven and three-quarter million dollars, and on about even terms with copper, petroleum and brick. The output of asbestos in 1880 (eleven years ago) has been but 380 tons, amounting to $24,700. Since then the industry has steadily increased, with the only exception of 1888, and has reached in 1890 9,860 tons, with a value of $1,200,240, taking the official figures as given by the Geological Survey, which, however, seem to me rather high, especially as far as the value is concerned. During the period between 1880 and 1890, the increase has been nearly 2,600% in tonnage and 5,100% in value.

It may be interesting to see what the average value per ton for these last ten years has been, as this is the only measure by which we can judge the industry from a national and economic as well as a business point of view. The years 1880, 1881 and 1882 brought to the asbestos miners a price of $65 in average, while the price per ton in 1883 reached $72. From here we find the average price steadily decreasing, owing to the large proportions of No. 3 asbestos, until it reached the lowest point in 1887 of $49. The respective figures are a trifle over $65 for 1884, $58 for 1885, $59.75 for 1886 and, as stated before, $49 for 1887; 1888 yielded an average of $60; 1889, $69.75, until 1890 brought the large figure of over $127 as an average price for every ton of asbestos, if the statements made by the Geological Survey are correct. This enormous increase in prices was due to several circumstances, chiefly relating to the state of the European market, and in particular that at the time a number of speculators had bought and kept from the market considerable amounts of stock in expectation of a further rise, while manufacturers as well were anxious to lay in as much stock as possible, under the impression that the mines had nearly reached the top of their capacity, and that prices would be driven to the utmost if stocks should run short. The real state of affairs transpired only when speculators tried to unload. Here a reaction set in, and while manufacturers before were very anxious to buy, they then decided to first await a settlement of the affairs. This, however, was promptly answered with the slacking down in the working of the mines last summer, and led in consequence and in consideration of other obnoxious circumstances—such as the Quebec Mining Act—to the entire shutting down of nearly all the mines in November last. Since then things have somewhat changed.

It is clear that a mineral which has been successfully exposed to a heat of 4,500 to 5,000 degrees F., which is a nonconductor of electricity and which may be spun like cotton and flax, has its merits in itself and will stand on those merits. The uses of asbestos are steadily increasing. I cannot, however, dwell on this point, and have to refer those who are especially interested in the subject to an excellent paper read before the Asbestos Club in September last by Mr. Ed. Wertheim. One thing though I would like to mention with regard to the market for crude asbestos, and that is that it seems as if the American market is now rather inclined to buy as good grades as the European, while vice versa, manufacturers on the other side of the water are taking up lower grades along with first qualities—circumstances which never prevailed before. So it seems that those two main buyers of our products—America and Europe—are coming on more even terms than ever before.

There is no doubt that the industry is still on a steady and very healthy increase, and while we may have temporarily to stand a slight reaction, things will brighten up before long. The sound judgment of those men interested in our industry will soon restore the balance between demand and production and will continue to develop the asbestos industry as wonderfully as they have done so far. The spirit of congeiality which assembles us to-day, and which has fonnd its expression in the formation of the General Mining Association of the Province of Quebec and the Asbestos Club of Black Lake, will aid to this end for the glorification of the Dominion of Canada and its world-known asbestos industry.

Recent Practice in Economical Air Compressors.

By F. A. Halsey, Sherbrooke, Que.

It has long been a source of surprise to the writer to note the degree by which the steam engineering of air compressors has lagged behind that of other consumers of power in connection with mine work. The indicated horse-power allowing for stoppages and averaged throughout the day, for the compressor of the average mine is not less, probably, than from ten to twenty times that of the hoisting engines of the same mine. Nevertheless, engines of the most refined and economical construction are often seen in use for hoisting purposes, while beside them will be compressor plants of, as stated, from ten to twenty times the developed power, and driven with perhaps plain slide valve engines. In the mining section, where, so far as the writer's knowledge goes, the steam practice is more advanced than elsewhere on this continent—Northern Michigan—the above statement is emphatically true. Hoisting and pumping engines of the finest and most advanced design and construction have been in use there for years as a matter of course, but until recently very ordinary engines have been considered good enough to drive compressors.

When compressed air mining machinery was first introduced it was of course of a somewhat experimental nature, and the air compressor occupied a less prominent position as a fuel consumer, both relatively and absolutely, than now. Under these circumstances it is not to be wondered at that the first compressors should have been built chiefly with a view to economy of first cost. That day, however, has long passed, and there is not now, as indeed there has not been for the past five years, any justification for the continued popularity of compressors designed in absolute defiance of every principle of steam economy. Persistent advocacy has indeed rendered the merits of the plain duplex type of compressor comparatively well understood; nevertheless, for the sake of completeness to the argument, it may he worth while to rehearse them here. The chief point of superiority lies in economy of fuel, the reason for which is as follows :—

In compressing air the resistanec of the air against the piston is nothing at the beginning of the stroke, from which it rapidly increases, reaching its highest near the end of the stroke. If steam is to be used with economy it must be cut off early in the stroke, after which its pressure rapidly falls, being at its lowest at the end of the stroke. Thus we have, at the end of the stroke, a high air pressure with only a low steam pressure to overcome it. If the steam is to be used with economy, as above outlined, the deficiency in the power of the steam must in some way be made up. To accomplish this there are two means at disposal with the duplex construction, while with the straight-line form there is none.

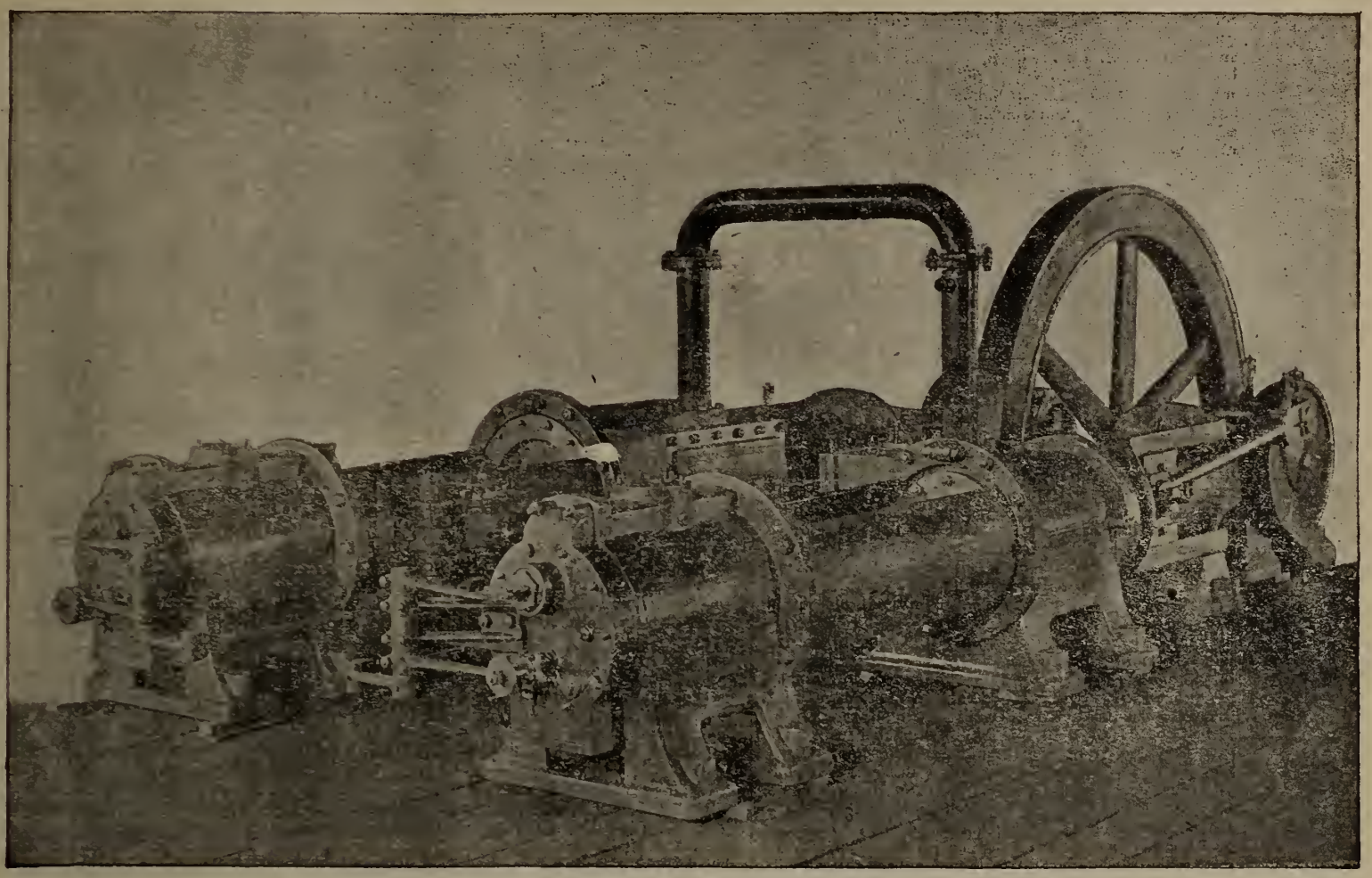
1st. The two cranks may be placed at right angles to one another, with which arrangement each steam cylinder is at its best advantage at that point of the revolution where the other is weakest.

2nd. A large, heavy fly-wheel may be employed.

The first device is, from the nature of the case, impossible of application with the straight-line form, and the second is almost equally so. While, of course, fly-wheels are added to straight-line compressors, they are entirely inadequate to the work required, for the reason that there is not room for wheels of sufficient diameter or weight, while in the duplex form there is plenty of room for any wheel desired. In duplex compressors it is customary to use a wheel of double the diameter and double the weight—that is, four times the regulating power—of the largest which it is practicable to employ with the straight-line type of the same size of cylinder. The result is shown to the eye in trying to run the two types at a low speed: owing to the deficiency of fly-wheel the straight-line machine works with an unsteady motion, slowing up at each centre and stopping if a too slow speed is attempted, while the duplex works with a steady motion at a much slower speed than it is possible to run the straight-line at all. The duplex machines can be run with a full load at as low as ten turns per minute, while the straight line form cannot be run with a load at a slower rate than about thirty to thirty-five per minute. The result of this superiority in fly-wheel capacity is, that while it is entirely feasible to run the duplex machines with the steam cutting off at one-fourth the stroke, it is not practicable to run the straight-line machine with a shorter cut-off than about two-thirds of the stroke, and the superior economy of the duplex machine is represented by this difference in the cut-off.

The practicability of using steam with an early cut-off is not, however, the only source of economy in the duplex machine. The capacity for running with extreme slowness at times is an extremely valuable one in connection with regulation. It frequently happens in every mine that the demand for air becomes temporarily almost nil, and the feasibility of running with extreme slowness enables the duplex machine to be brought down to a speed which will meet this condition, but a speed, nevertheless, at which it is producing air in proportion to the fuel consumed. With the straight-line machine it is impossible to run with such slowness, and "unloading devices" are introduced to stop the machine from compressing air that is not wanted and can only be thrown away at the safety valve. This purpose is accomplished, but at the expense of running an idle machine, and also of forcing the air back and forth through the small passages of the unloading device. Of several indicator cards in the writer's possession, taken with this unloading device in operation, the most favorable shows an area of 14 per cent. of the regular compressor card, and if to this we add the percentage customary for the work of driving the idle machinery, we shall see at what a cost of fuel this unloading device accomplishes regulation.

The only objection that has ever been urged against the duplex compressor is, that it "produces a torsional strain on the shaft." Granted; but what is a shaft for? How many engine or other shafts are there in the world that do not carry a torsional strain? Who ever heard before that it was objectionable to have a shaft carry a torsional strain? In point of fact there is no strain except, perhaps, simple tension that is so easy to provide for and which gives so little cause for anxiety as torsion. What shall be said, however, of the alternate bending strain of the long cross-head of the straight-line machine? This is, perhaps, of all strains, the most difficult to provide for; and in point of fact, while no one ever heard of a duplex



12 x 18 Duplex Air Compressor,
With Compound Condensing Engine and Positive Motion Air Valves. Designed and Built by the Canadian Rand Drill Co., Sherbrooke, Que.

ompressor shaft giving out, the same cannot be said of the straight-line cross-heads.

The above course of reasoning is so entirely in accordance with the first principles of steam economy that it has to a large extent prevailed, and the said plain duplex type of compressor has become a popular and standard one; but there the matter has rested. Despite the merits of the plain duplex, as compared with the straight-line compressor, no one in this day and age can claim a simple, non-condensing engine to represent a high development of engineering practice. Now it would seem that the first thought natural to a man after being convinced of the soundness of the above reasoning would be: "But your duplex machine contains two steam cylinders; why not make one larger than the other, connect them in series instead of in parallel, and thus, at the trifling additional cost of a few pounds of iron and the boring and fitting of a large cylinder instead of a small one, secure all the economy of a compound engine—an economy so great that ten times the amount required here per horse-power is often expended to secure it, and the result proven to be a paying investment." Unlike hoisting engines, moreover, compressors are well adapted to be connected to a condenser, and where water is available no reason can be found why they should not be so connected. If our supposed enquirer were a little further versed in steam practice it would soon occur to him that since a compound engine requires less steam than a simple one, its boiler may be smaller, and that slight as is the additional cost of the compound condensing machine, it would be in considerable measure offset by the saving in the cost of the boilers.

The writer has presented arguments similar to the above for more years than he likes to own; but he has, until recently, presented them to deaf ears. During the past two years, however, there has been a decided awakening on this subject, and the American company with which he is connected has put out a considerable and increasing number of compound condensing compressors, and the same influence has been at work to at least a proportionate degree here.

The first machine of this description built here is shown in the accompanying illustration, and a larger size has since been called for, the first of which is now being erected and will soon be in commission.

It is not necessary at the present day to present figures of fuel economy of compound engines to show that the money spent on them is well invested; nevertheless, the adaptability of the duplex compressor to compounding is so great, and the consequent additional investment is so small, that the figures in the present connection are of such a surprising nature that the writer gives them as a matter of general interest. The writer's firm was, on a recent occasion, asked to furnish alternative bids for three plants of the same capacity, boilers included, but of the straight-line, plain duplex and compound condensing duplex types, respectively. The figures submitted furnish the basis of first cost, from which the following results are obtained. As a basis of fuel consumption the compound condensing compressor is rated at 2 lbs. of coal per horse-power per hour, and the plain duplex at 3½ lbs., which figures fairly represent the results from those types of engine when operated under working, not test, conditions. Of the straight-line machine the writer is not aware of any careful measurements having been made, but considers 5 lbs. per horse-power per hour as a fair assumption. Using the above as a basis, it is a simple matter of multiplication to determine the length of time necessary for the more expensive plants to return the additional outlay in the saving of fuel effected, and the astonishing results obtained are, that with the compound compared with the plain duplex, the extra first cost of the former will be returned in three months; with the compound as compared with the straight-line, in four and one-half months, and with the plain duplex as compared with the straight-line, in six months. In these calculations the mine is assumed to run two shifts of ten hours each per day, and coal to cost $4 per ton.

The illustration shows a compressor fitted with the writer's positive-motion air valve gear. The subject of this paper relates, however, to the economics of air compression, and no description of the valve gear will be made further than to call attention to the fact that the suction valves are surrounded by hoods properly fitted for connection to flues for leading cold out-of-door air to the compressor. This is a minor source of economy which has been strangely neglected in the past. The economy of fuel obtained by this provision is one per cent. for each five degrees difference of temperature between the inside and outside air. In a climate like that of Canada this can be easily made to aggregate eight or ten per cent., and there are few sources of economy of that extent which can be secured at such a trifling outlay.

The Club House Dinner.

After a vote of thanks to the chairman, to the asbestos mine owners for their kind reception and entertainment, and to Messrs. Halsey, Smith and Klein for their papers, the members adjourned to the dining-room. Here the local committee had gone to much trouble and inconvenience to provide an elegant repast. The menu card, too, was quite a work of art, and deserves notice for the fine artistic and literary tastes displayed by its designers, Messrs. John Penhale and L. A. Klein. A brief toast list was submitted, after which the members spent the remainder of the evening in social intercourse. The party broke up about one a.m., having thoroughly enjoyed one of the best meetings since the organization of the Association.

A trial was made on 18th ulto., at Nanaimo, B.C., of the electric locomotive in the New Vancouver Coal Co's. shaft. The locomotive made a number of trips on the track drawing a few cars with coal. Mr. Wise, District Engineer of the Edison Electric Co., and S. M. Robins, Superintendent of the Vancouver Coal Co., were present. When thoroughly established these locomotives will do away with a large number of mules now employed in hauling cars.

LEGAL.

Kimberley v. Stewart—More Side Lights on the General Phosphate Corporation.

The last English mail brings advice of the action of Kimberley v. Stewart, which was tried lately before Mr. Justice Wright and a common jury, at the Guildhall, London.

Mr. Nathaniel Gold Kimberley, an engineer residing at Southgate, sued Mr. Geo. Stewart, of Buckingham, in the Province of Quebec, Canada, to recover £660 commission, on the sale of certain phosphate properties in Canada, known as the High Falls and the Upper Lots, to the General Phosphate Corporation, Limited. Plaintiff also sought to recover the value of 2,340 fully paid up £1 shares, agreed by the defendant to be allotted to him as further commission on the sale, or the sum of £2,340 as damages for breach of agreement. In the alternative, he claimed £3,000 for commission for services rendered in relation to the sale. Mr. Herbert Reed and Mr. Carrington were counsel for the plaintiff and Mr. Clavill Salter for the defendant.

Plaintiff's case was that prior to March 13, 1890, defendant was interested in the phosphate properties in question and being desirous to sell the same to a company requested the plaintiff to take steps with a view to their sale, and agreed, in the event of their sale being carried through, to pay him a commission of £660 in cash and cause to be allotted to him or his nominees fully paid up shares in the company purchasing the property of the nominal value of £2,340 out of the shares taken by the defendant in part payment. The payment was to be made to the plaintiff at such time as the defendant received payment for the properties. In July, 1890, a sale was carried through, and in consequence of the plaintiff's introduction, the properties were purchased by the General Phosphate Corporation, Limited, for £40,000 pounds, £10,000 in cash and £30,000 in fully paid up shares. Plaintiff now sought to recover his commission on the transaction, together with £3,000 for work done and money expended at the plaintiff's request. The defendant admitted that he was the owner of the properties and that the sale was effected to the General Phosphate Corporation, but said it was not upon the terms arranged. Defendant was willing, in March, 1890, to accept for the properties £27,000, but the plaintiff and his associates, proposed that the price should be raised to £54,000 in order that they might form a company to purchase at that price, and in order that the difference between that sum and the sum which the defendant was willing to accept, might be divided between the plaintiff and his associates, and the agreement alleged by the plaintiff was conditional upon a sale at such increased price being carried into effect by a time fixed or within a reasonable time. The plaintiff and his associates, however, entirely failed to carry the sale into effect and to bring out the proposed company or any company for the purpose of purchasing

the defendant's properties, and after several extensions of time, the defendant, in or about the month of May, 1890, withdrew the sale of his properties from the hands of the plaintiff and his associates, and made other arrangements. In June the Phosphate Corporation was formed, but was under no obligation to purchase the defendant's properties, and in the month of September the defendant contracted to sell at the nominal price of £40,000, but the defendant was only able to effect the contract by accepting onerous terms, in particular, the deposit of £10,000 and the payment of another sum, £11,000, to another person, and no money or shares ever became payable to the plaintiff in respect of such sale. The defendant denied that he ever employed the plaintiff to work or render services or pay money for him as his agent or otherwise. He contended that any work done, or money paid by the plaintiff, or by him, was paid and done on his own behalf by the plaintiff and in his own interest, and not at the request or on the behalf of the defendant. The defendant had never received either money or shares on behalf of the plaintiff. It appeared from the evidence of Mr. James Davidson, (solicitor), that in the General Phosphate Corporation the public subscribed between 19,000 and 20,000 £10 shares, that the shares were not now quoted on the Stock Exchange, there being no dealings in them, and that they were of no value for purposes of realization, though what they were worth for the purpose of holding the witness could not say. The amount Mr. Stewart had received in cash for his properties was £11,000, though the total sum it was arranged he was to receive in one form or another, was £40,000.

The jury found for the plaintiff for £660 pounds and estimated the value of the shares at £5.

Judgment was given for the plaintiff accordingly.

Aggravated Assault upon Mr. J. Lainson Wills.

At Aylmer, on Tuesday 12th inst., before Magistrate St. Julian, W. R. Stewart, one of the employés of the General Phosphate Corporation, and son of Mr. George Stewart, vendor and late contractor to the company, was charged with an aggravated assault upon the person of Mr. J. Lainson Wills, late manager to the company. The assault took place at Buckingham on the evening of the 9th inst. The prisoner, pleading guilty, was fined $10 and costs.

The libel suit brought by Robert Robertson, underground manager at the Sydney mines, against the Stellarton *Journal* has been dismissed.

Several cases interesting to workmen were tried at the supreme court in Sydney lately. A man named Alex. Whyte sued the Sydney & Luisburg Coal and Railway Co. for damages for injuries received while repairing a boiler. Whyte was in a boiler which was one of a set of four. A fireman blew off one of the boilers the consequence being that Whyte was scalded, as the blow-off cock on the boiler on which he was at work was also open. The judge ruled that Whyte had no cause of action. The case was appealed.

Three miners named Evans, Job and Hannington sued the General Mining Association for injuries received by being precipitated, while riding in the cage, to the bottom, through defects in the hoisting machinery. After considerable evidence had been heard the jury awarded Evans $1,000, Job $200, and Hannington $100 damages.

Notes on the Detonation of High Explosives.*

By William J. Orsman, F.I.C., F.C.S.

To realize thoroughly the difference between the older explosive mixtures—as typified in gunpowder—and the modern high explosives now coming more generally into use, it is necessary to understand what part the question of time plays in the decomposition of any explosive substance. To this end we may divide explosions into two distinct classes: firstly, those caused by intensely rapid combustion, such as may be obtained by applying a light to a mixture of coal gas and air, or by the burning of an intimate mixture of carbon, sulphur and nitre, as in ordinary powder; whilst in the second class you have many substances which do not come under the head of combustible bodies, such as nitrate of ammonia and most compound gases, *e.g.*, nitric oxide, and even carbon disulphide gas, which may be decomposed or split up into their elements by means of an intense shock. This shock can be brought about by the formation of an explosive wave, called detonation, and is most conveniently started by the explosion of a small quantity of mercury fulminate. There are other known bodies more powerful than this, for instance, fulminate of silver and iodide of nitrogen, but these are so sensitive that they decompose at the slightest touch, and it is only a matter of degree in obtaining a sufficiently powerful detonator when ordinary substances will decompose and become explosives.

We are apt to consider the explosion of gunpowder as being instantaneous, but the time occupied is enormously greater than in the detonation of the high explosives, and it is for this reason the powerful effect is so great. Our 100-ton guns require hundredweights of powder to execute the given work, whilst a fiftieth part of the weight, say of dynamite, would shatter the breech and, perchance, not eject the projectile at all, With the slow-burning powder the *vis inertiæ* of the projectile is overcome gradually, the increasing impulse being applied till the ball reaches the mouth of the cannon, when it has its greatest velocity; but with the quicker decomposition of a high explosive the full shock is applied at once, and all the surrounding parts alike are acted on. As an example of the rapidity with which such bodies decompose under the influence of a detonating wave, the decomposition of a train of guncotton, laid from Wigan to London, would take about one minute. As nearly as much gas being given off from gunpowder as from an equal weight of dynamite, the extra work done by the latter must be due to the quickness of explosion, and the powerful action of the high explosives is due to this circumstance.

The next thing to decide is, which of the high explosives is the safest and most economical to use? As the question of safety is of the first consideration, I will mention the following heads which will conduce to this condition :—

1. The temperature of detonation must be as low as possible.
2. The products of decomposition shall be entirely gaseous.
3. The explosive shall not be liable to detonation except by means of a detonator.
4. The explosive shall not be liable to ignition by means of a spark, fire, or partial misshot of a detonator.
5. The products of decomposition, that is to say, the resultant fumes, shall not be poisonous.
6. The cartridge must not be liable to freeze.

To fulfil the above requirements seems at first blush to be a difficult task, but I hope to show you that it is possible to satisfy them to a remarkable extent, provided the explosive be properly handled.

No. 1—As regards temperature, the following table, compiled from the researches of the most eminent men, will show the differences between the most prominent explosives :—

	Degrees Centigrade.
Blasting gelatine	3,220
Nitro-glycerine	3,170
Dynamite	2,940
Guncotton	2,650
Tonite	2,648
Picric acid	2,620
Roburite (below)	2,100
Nitrate of ammonia	1,130

Coming to the second, the gaseous properties of the ultimate products is most important, for here the dangerous properties of gunpowder are very prominent. All explosives containing metallic salts or infusorial earths, such as potassium, sodium, or barium compounds, keiselguhr, clay, etc., and these include powder, tonite, dynamite, gelignite, etc., when they are detonated, foul, to use a sporting expression, that is to say, a large amount of solid matter is projected at a high temperature, and such solid matter coming in contact with mixtures of coal gas or coal dust and air invariably causes explosion.

The third and fourth conditions must be patent to every careful thinker of the subject, as the liability of any explosive to catch fire and burn in the hole is a circumstance that ought not to be allowed for an instant. In trying any new explosive the experiment of inserting a lighted piece of tape fuse in a cartridge will give ample evidence of the safety in this direction. Cases have repeatedly occurred owing to a partial mis-shot, of the cartridge being projected out of the hole in a burning condition. If it is unsafe to use a cartridge of this description, it is equally unsafe to use tape fuse, and for the detonation of really safety explosives electrical firing should be resorted to. Many accidents have occurred, as at the Boythorpe Colliery, through the use of tape fuse, and invariably the blame is shunted on to the explosive. With regard to the fumes question, much has been and can be said, but until the workmen have a more accurate knowledge of the composition of the explosive itself, and the deduction therefrom of the products of decomposition, very little headway can be made. The experience of the last few years and the action of the Miners' Committee in Durham, ought, however, to have some weight, and I should like to lay down as a general rule, that only those explosives having an excess of oxygen, that is to say, containing enough oxygen to completely burn up the carbonaceous matter, can be called free from poisonous gases when exploded. Many attempts have been made and with partial success to tone down the temperature produced by the explosion of nitro-glycerine compounds, such as gelignite and carbonite, by means of wood meal The ultimate effect has been, and carbonite is the worst offender of all in this respect, that the production of a large volume of that odourless, colourless, but most poisonous gas carbonic oxide or carbon-monoxide. This gas (1 per cent. in the air being fatal) acts in a peculiar way on the blood, robbing it of its oxygen, and thus taking away its life-giving power.

We can easily show that carbon-monoxide is formed when carbonite is detonated, for if we explode say 10 grains of this explosive in a confined space and collect the gases formed, we find that these gases burn with the characteristic blue flame as given by carbon oxide, and further analysis shows its presence to a remarkable extent.

The following table gives the composition of the six prominent explosives, and shows the composition of the gases formed on explosion. The gases are collected by detonating ten grammes of each in a closed strong steel cylinder having an internal diameter of five inches :—

Explosive.	Volume of Gas Formed.	Composition of Gases. Per cent.			
		CO_2.	CO.	CH_4 & H	N.
Gunpowder— Parts					
Nitre..... 75					
Sulphur..... 10	2214	51.3	3·5	3·5	41.7
Charcoal 15					
Gelignite—					
Nitro-glycerine ..56·5					
Nitro-cotton..... 3·5		26	7	..	67
Wood meal..... 8					
Potass. Nitrate...32	4980c.c.				
Tonite—					
Nitro-cotton..(varies)		30	8	..	62
Barium Nitrate.....	3750c.c.				
Roburite—					
Ammonia nitrate . 86					
Di-nitro-chlor-benzol..... 14	4780c.c.	32	.	..	68
Carbonite—					
Nitro-glycerine. .. 25					
Wood meal..... 40		19	15	26	40
Potass. Nitrate... 34	2100c.c.				

Mr. H. HALL said there was one point in Mr. Ashworth's paper worth while calling their attention to. Mr. Ashworth states that in stemming a hole there is as much strength in 7 inches of tamping in a 1 inch hole as there is in 18 inches of tamping in a 2 inch hole. He also points out that many people who are using the high explosives are using them in the same size of holes as they originally used gunpowder in, and he goes on to point out that there would be much advantage if the size of the hole were lessened, and they would get a better tamping and safeguard against blown out shots. He thought there was another point, and that is that when they put a high explosive into a large hole they get all the force at the back of the coal, and it was doing its work at one particular point of the coal, whereas if they brought it along the hole the same as gunpowder they got a bearing on a greater length of the whole, and it might lessen the breaking up of the coal, and so they gained an advantage in that way. There was a statement which he thought must be a mistake. Mr. Ashworth said that when one of the shots was fired in the Ashton Deep Pit the ventilation was at the rate of 50 ft. per second. That appeared to him (Mr. Hall) to be a mistake.

Mr. GRUNDY said Mr. Ashworth had not seen the place. He told him (Mr. Grundy) so. The circumstances connected with the firing were peculiar, and the velocity was great.

The Hon. SECRETARY said the paper had been submitted to Mr. Ashworth before publication for correction.

Mr. GRUNDY: I do not think he is far out of it. I can give you the exact figures.

Mr. COCKSON pointed out that there was clearly a clerical error on pages 340 or 345 in reference to the explosives that were used in the shot that caused the accident at Ashton Moss Colliery. Roburite was mentioned in one of these contradictory paragraphs, and had the reader of the paper been present he would have asked him to withdraw any mention of roburite, as it certainly had nothing to do with the Ashton Moss accident. Looking at the main conclusions drawn by Mr. Ashworth, he agreed with all of them, except his theory of detonating vibration, and disagreed with Mr. Grundy when he said that the experiment of trying to ignite a high explosive with ordinary fuse was not of much service. In his opinion it was a most useful test, as an explosive that could be ignited in such a way was not suitable or safe to use in fiery or dusty mines. With regard to the use of smaller boreholes for high explosives, there was no doubt by so doing the explosive would give better results, and there would be less work in boring; but as there was no risk of inflaming gas by a vamped roburite shot blowing out, the question of greater safety did not apply to that explosion at any rate. He agreed with Mr. Ashworth that at Altoft's Colliery sprinkling by water had not proved a safeguard against the use of gunpowder, nor could he think it practicable in any way to effectively water a dry and dusty mine, of any considerable area, against what he considered the very serious danger of an explosion of coal dust caused by a gunpowder shot or other unsafe explosive.

Growth of Mining in British Columbia.—The collieries of Vancouver Island are yearly growing in importance, and giving employment to 3,194 hands. The output of coal for the year 1891 was 1,029,097 tons, compared with 678,140 tons during the previous year, notwithstanding the foreign coal markets have for some time past been unfavourable. The quality of this coal is not equalled on the coast. In the interval between 1st of July 1858 to December 31st 1891, the province has yielded gold valued at $53,113,127. The district of Cariboo still heads the list as a gold producer. The Kootenay district is undoubtedly rich in silver-bearing ore, but development work is backward. However, an 80 ton smelting plant now being erected on Kootenay Lake, will no doubt help to improve matters at an early day.

* Transactions Manchester Geological Society.

Extraordinary General Meeting of the General Mining Association of Quebec.

An extraordinary General Meeting of the General Mining Association of Quebec, was held on Wednesday, 20th inst., in the offices of the treasurer at Montreal. Among others present were: Hon. George Irvine, Q.C., (Johnson's Co.), Quebec, President; R. T. Hopper, (Anglo-Canadian Asbestos Co.), Montreal; J. Burley Smith, M.E., (British-American Phosphate Co.), Glen-Almond, Que.; Dickson Anderson, Montreal; Capt. Robt. C. Adams, (Anglo-Canadian Phosphate Co.), Montreal; S. C. Stevenson and A. W. Stevenson, Montreal; Hon. John McIntosh, Compton, Que.; W. E. Bell, Toronto; B. T. A. Bell, Ottawa, Secretary, and others. Hon. Mr. Irvine presided. The meeting having arranged some preliminaries anent the forthcoming Mining Convention, proceeded to discuss Quebec's mineral exhibit at the World's Fair. The Hon. John McIntosh, Commissioner of Quebec, explained that the Government's grant for the whole provincial exhibit amounted to but $12,000. He asked for the co-operation of the Association promising free transportation of, and safe return of specimens. He thought that the exhibits should be properly explained by some competent person conversant with the mineral industries and the extent of the Province's resources, and asked that the expenses incident to this might be borne by the operators. Mr. S. C. Stevenson, who has had much experience in Government exhibits in different parts of the world, claimed that the principle of the various Provinces being represented by independent exhibits in addition to a general exhibit by the Federal Government, was wrong. In minerals there was at Ottawa in the Museum of the Geological Survey, an unrivalled and thoroughly representative collection which should be utilized. The Government at Quebec could not make a better, and representations should be made to have this collection sent. After some further discussion by Capt. Adams, Mr. Hopper and Mr. J. B. Smith, it was moved by Capt. Adams, seconded by Mr. A. W. Stevenson: "That Mr. James King, M.P.P., J. Burley Smith, and the Secretary, be a committee to co-operate with the Hon. John McIntosh, and that said committee be authorised to interview Dr. Saunders, the Canadian Commissioner at Ottawa, with a view to securing the co-operation and assistance of the Dominion Government in the proposed exhibit of minerals from the Province of Quebec." The meeting then adjourned.

Diamond Drill Tests for Proposed Tunnel Scheme, Straits of Northumberland

Messrs. McRae & Company, Ottawa, who have the contract for test borings on above work, received the following report a few days ago:

The tests on the New Brunswick shore were completed about the 5th July. The carboniferous base work has been traced and penetrated at 3 distinct points; and it is clearly shown that the soft red shales and sandstone of the lower Permian of Prince Edward Island runs across the straits and repose with a gentle incline on the northern border of the New Brunswick system.

A point of serious investigation has been to determine whether the Tormentine anticlinal runs right across to Cape Traverse, or turns to the eastward in the direction of Hillsborough Bay. The latter now appears to be its true direction, so that the tunnel beds lie in an undisturbed position in a broad syncline, whose eastern extension underlies the rich green swells of southern Prince Edward Island.

Two test borings have been completed out on the water, and 24 more will be made across the straits, and two on the Island.

Iron tripods 100 feet long are anchored firmly. A 3 inch heavy iron casing pipe is then driven about 15 feet into the bed clay, and the drill outfit is attached on a frame work above the tripod. Steam is supplied from the boiler which is placed on a scow anchored alongside. The first hole was completed in 1¾ days; the second, however, owing to stormy weather, took three or four days longer.

Allowing for delays by storms, in two months the submarine tests should be completed, and a week or so longer would be sufficient for the terra firma borings. The outfit was manufactured by the American Diamond Rock Boring Co., of New York, and has been specially equipped with double core barrels, casing pipes, etc., for submarine work. The average drilling has been about 30 feet per day. Mr. Albert Palmer, C.E., of New York, directs the work, and the drill outfit is under the management of Mr. James Kelly, an expert driller, of Ottawa.

MINING NOTES.

[From Our Own Correspondents.]

Nova Scotia.

In our next issue we will publish in these columns an illustrated article by Mr. John E. Hardman, S.B., M.E., of Oldham, on "Recent Gold Milling Practice in Nova Scotia." A complete set of Mr. Hardman's drawings will accompany the paper.

A capital hoisting record was made for Cape Breton on 9th inst. at the International colliery, when 1,508 boxes, or 1,452 tons of coal were hoisted from a single shaft. 2,600 tons were shipped on the same day from the company's pier.

Quebec.

Lievres River District.

The phosphate in bins and at the mines of the General Phosphate Corporation was seized by creditors during the month. The denouement cannot be far off.

The Phosphate of Lime Co. is working a reduced force at High Rock. Mr. Walter Pickford, the former superintendent, is expected from Florida on a visit to the mines during the month.

The property of the Squaw Hill and Ætna mines was formally transferred from the Anglo-Continental to the British Phosphate Co., Ltd., last month, and the conveyance was duly registered at Hull.

The phosphate deposit lately struck in the Crystal Pit at Ætna, operated by the same company, bids fair to hold on to a good thing. "We are still sinking in the vein," writes Mr. J. Burley Smith, the manager, "which continues to widen as we get down, and the ore is of a very pure quality. It is undoubtedly a true right-running vein N. E.-S. W. We are driving on it at three levels, three drifts to the S. W. and two to the N. E., and as we descend shall drive others in the same directions at lower levels. Having discovered this deposit at such a considerable depth, 105 ft., there is every prospect that it may continue to a great depth. The shaft is inclined in accordance with the inclination of the vein on which we are sinking. Self-dumping cars are let down on a cage and run off on to tramways laid down in each drift. The ore is thus put into cars at the point at which it is blasted out, and taken right up into the cobbing house at once and washed and cobbed. The shaft and different levels are lighted by 25 incandescent electric lights of 16 candle power each, by means of which the miners can see much better how to mine without waste, as the different colours of the associated vein stuffs are readily distinguished and the ore can in a great measure be separated in the pit and sent up to bank, thus saving considerable cobbing labour. This pit is now making a considerable weekly output of high grade ore, which, I am happy to say, increases in quantity from week to week, and will, I am sure, very shortly produce an output something in accordance with our first anticipations. The electrical energy for the lamps is supplied from a small engine and dynamo, worked by surplus steam power from steam hoist boiler. The pit and various levels are kept cool and thoroughly ventilated by a Sturtevant steam blower."

Township of Hull.

Mr. A. W. Stevenson has leased his phosphate-mica property to the Waters company, who are now operating it for the latter mineral.

Eastern Townships.

The asbestos mines have resumed operations and are working, with but one or two exceptions, full force.

At Thetford, the Beaver Asbestos Co., are working a good strong force and are turning out a quantity of nice asbestos. They are also building, near the line of the Quebec Central Railway a large cobbing and store house, 30 x 100 feet.

Mr. Geo. R. Smith has been appointed superintendent of the mines of the Bell's Asbestos Co. This company are working a good force of men.

The Ward Bros., Ross & Co., have not reopened their mine as yet.

Messrs. King Bros. are mining both at Thetford and Black Lake.

Dr. Jas. Reed has re-opened his mine and is getting out some good asbestos.

Some good finds are reported on the Johns property, adjoining Dr. Reed.

At Black Lake, the Glasgow and Montreal Asbestos Co. has a large force of men on and they are getting some fine fibre from the lower end of their property. A number of new derricks have been put up this spring and the capacity of their hoisting engines increased by the addition of two drums to their engines.

The United Asbestos Co. has a strong force mining, and the output is very good. They are, in addition to their regular mining work, working a large force of men cutting and grading for a tramway over the hill, to convey the waste rock and rubbish from the pits to the back of their property, which, when completed, will be of great service to them in unburdening valuable ground of the rock that now covers it.

Capt. W. Prideaux, has been appointed superintendent at the mines of the Anglo-Canadian Asbestos Co., Ltd. This mine is being worked with the usual force, and their output is very good.

Some good asbestos has been discovered at East Broughton in the openings made by Mr. H. N. Williams. The formation there is different from that at Thetford or Black Lake.

Some work is being done on the Lambley mine at Coleraine station. Some very fine samples of asbestos are shown from this place.

Templeton District.

The Lomer Mine has been showing up remarkably well for the past six weeks. In the big pit, 20 tons of high grade ore are daily taken out, in addition to about 20 tons No. 2. Work for the past five weeks has been confined exclusively to the big pit. One hundred men and boys are employed.

The Templeton Asbestos Co. are working a gang of 16 men. Some good sized stuff has been struck. The serpentine rock is being sawed and shipped to mill at Buckingham, where it is being ground for German market. It analyses as follows:—

	Per cent.
Silica	40·52
Magnesia	42.05
Iron oxide	1.97
Alumina	2.10
Water	13.36
	100.00

The Templeton and North Ottawa Co. are doing some development work on their properties near McGregor Lake, where large surface shows of amber mica are being tested.

The Electric Mining Co. have a gang of 18 cobbers preparing phosphate for shipping. Mining will not be resumed until November.

Ontario.

Port Arthur District.

Favorable reports continue to be received of the work done on the Climax property.

Work has been resumed on the Badger-Porcupine mine. This mine, like that of the West End of Silver Mountain, is one of the solid mines of this district, and it is much to be regretted that misunderstandings and consequent litigations should have resulted in even a temporary suspension of work while there is smelting and other ore in sight.

The following are the statistics of the export of silver ore by companies from this district:—

Silver Islet	$3,250,000
Duncan	20,000
Thunder Bay	12,000
Beaver	309,700
Badger	294,064
Porcupine	1,000
Silver Mountain (West End)	15,450
Crown Point	7,800
Huronian (gold and silver)	6,700

In addition to shipments enumerated above, the East End Silver Mountain expressed $50,000 worth of silver to Liverpool, Eng. There are also various smaller mines which have shipped considerable quantities of ore of which the consular or customs departments have no records easy of access. It is, however, admitted that the actual shipments largely exceed four million dollars.

For the year ending 31st December, 1890, we learn from the same reliable sources, that there was shipped to the United States, the following:—

Beaver	$ 80,000
Badger	95,000
West End (Silver Mountain)	2,450
	$177,250

For the year ending 31st December, 1891, the shipments to the United States were:—

Beaver	$104,800
Badger	104,100
Silver Mountain (W.E.)	10,000
Palisades	1,000
Various prospects	300
	$220,200

Thus shewing an increase for the year 1891 over 1890, of $41,950.

Port Arthur is likely to be the first city in Canada to have a mining school. The town of Port Arthur has passed a by-law granting $3,000 toward the erection of

the school and will give $1,000 a year for ten years toward its maintenance, while the Ontario government has placed in its estimates a sum equalling that of Port Arthur for the erection and also $2,000 a year for the maintenance of the school. The municipality of Shuniah will also, it is thought, pass a by-law making a grant for its maintenance.

Sudbury.

Reports from the nickel mines here show that all the works are in full blast, the Copper Cliff, Blezard and Murray mines being worked to their full capacity.

British Columbia.

Nanaimo.

The shipments of coal for last month amounted to 54,317 tons, or a decrease on the previous month of about 3,000 tons. The exports by companies was as follows: New V. C. Co., 30,042 tons; Wellington colliery, 14,344 tons; East Wellington colliery, 965 tons; Union colliery, 8,956 tons.

At the annual general meeting of the employees of the New Vancouver Coal Co., held the other day, the report of the medical committee and their financial statement was presented. A medical and accident fund has existed among the miners of this company during the past three years, which is maintained by a monthly subscription of 25 cents per head of every employee. Last year's balance sheet showed a deficit of $153.45. This year there is a balance of $184. The receipts during the year ending May 30th, 1892, amounted to $15,878.75, and the payments to $15,695.75, including the surgeon's salary of $9,817.30. The number of accidents that came under the committee's notice for the same period and in which relief was granted, was 133. At this meeting the appointment of a mines' doctor took place, with the result that Dr. E. H. Praeger was retained. There had been a movement on foot among a number of the miners to do away with the present system of every man employing the same medical man, and to make arrangements whereby each man could employ whoever he chose; however, when the time came, the feeling had veered around in favor of the present incumbent, who is beyond doubt a thoroughly capable surgeon, and he was re-appointed with the almost unanimous consent of those present.

Mr. A. Dick, Government Inspector of Mines, who has returned from an official inspection of the Union mines, reports everything to be going on very satisfactorily. The number of men employed is not so great as it might be, but those that are working are employed steadily. A new electric pumping apparatus for the No. 1 shaft has just been received. The one already in use in another mine has been found to work with the greatest success.

Extensive operations are now, and have been for some time past, being carried on at the Newcastle Island quarry, of the New Vancouver Coal company of which Messrs. Carter and Nightingale are the lessees. About 20 men are regularly employed in getting out stone, and they have all they can do to supply the wants of the various contractors. Messrs. Carter and Nightingale have the contracts for supplying stone for the new buildings now being erected in Vancouver for the banks of Montreal and British North America, and also for the drill shed at Victoria. The gang of men employed in the quarry are comfortably lodged and boarded on the Island, where good, substantial frame buildings have been erected in close proximity to the works. The sandstone quarried out has not yet been equalled by that turned out of any of the other quarries in the province; it is used in almost all the large buildings erected either on the Mainland or Vancouver Island.

(From the *Miner*.)

J. Shields claims to have 12 feet on his claim, the Lucky Jim, in the Slocan district. Other reports say that he has only 30 inches. There is little doubt, however, that he has at least 12 inches of exceedingly high grade stuff. Five-sixths of the claim is bonded for $40,000.—$5,000 down.

An agreement made in 1890 between the original owners of the Silver King and Richard Day Atkins has been re-recorded. The certificates of the issue of crown grants for Silver King, Kootenay Bonanza and American Flag, have also been re-recorded. The dry-bones are beginning to rattle.

The owners of the Dictator intend to sink a 100 foot shaft on their elaim, and mean to put in the assessment work on the 4 or 5 other claims which form the group.

On Tuesday the United was visited by S. P. Palmer. The drift to the south is in 3 feet of ore on the same shute from which ore was shipped last year. Galena has been struck in the 150 foot level.

A. L. Davenport has a force of men stoping from the croppings of the Poorman lode down to the tunnel about 50 feet below. They are working at present in decomposed quartz running high in fine gold. Whenever development work is done on a large enough scale the Poorman will become one of the biggest mines in West Kootenay. The richest ore yet found running $300 to the ton in gold was got at the foot of a winze sunk 80 feet from the level of the main tunnel. A tunnel has been begun and run some 30 feet which is to tap the foot of this winze. Quite a little development work remains to be done before the property can be said to be fully shown up.

CANADIAN COMPANIES.

Canada Coal Co.—This company has applied for letters patent under Dominion laws for the following purposes: (*a.*) To buy and sell and otherwise operate and deal with coal, wood, iron and mineral ores; (*b*) To purchase, hire, charter, navigate and maintain such steamships and sailing vessels for the carrying and conveying of goods, chattels, wares and merchandise, and to carry on such business of carriers of goods as their business may require, with power to sell and dispose of the said vessels or any of them; (*c*) To purchase, rent, erect and hold for the purposes of the company such lands, wharves, docks, warehouses, offices, elevators and other buildings as it may find necessary and convenient for the purposes of the company, and to sell, mortgage and dispose of the same for the purposes of the company; with a capital stock of $50,000, divided into 500 shares of $100. The applicants are: Harry Jackson Watson, James Thorold Mathews, Albert Ernest Mathews, James Mathews and James Morgan, all of the City of Toronto, in the County of York, Province of Ontario.

The National Oil Co.—Applies for letters patent under Dominion laws. Capital, $150,000, in 1,500 shares of the value of $100. Head office at Petrolia. The applicants are: John McDonald, oil refiner; James Fiddes, oil refiner; William Adam, Braybrook, blacksmith; and William Edward Langford, accountant; all of the said town of Petrolia; and Charles Henry Schooley, of the city of Toronto, in the Province of Ontario, oil merchant; of whom the said John McDonald, James Fiddes and Charles Henry Schooley are to be the first or provisional directors of the said company. The purposes, within the purview of the Act, for which incorporation is sought, are: The purchase of refineries, plant and machinery; the carrying on of the business of buying, leasing, letting and selling petroleum oil lands and other lands; buying, selling and producing oil and crude petroleum oil and other products thereof; sinking and putting down salt and oil wells, and otherwise developing salt and petroleum oil lands; working, leasing, buying, letting and selling oil refineries and salt works; manufacturing, buying and selling salt and petroleum oil and other products thereof; storing, tanking and warehousing refined and crude petroleum oil and other products thereof, and granting warehouse receipts for the same; constructing and operating pipe lines for the transportation of oil, and the doing of all such other things as are incidental or conducive to the attainments of the objects aforesaid throughout the Dominion of Canada.

The Eagle Nest Gold Mining Co. of Ontario, (Ltd.)—Gives notice that application under the Ontario Act for incorporation, will be made in order to acquire, hold, lease, exchange and sell mining lands, and to develop the said lands by working mines, smelters, stamping mills and other necessary works, in the Province of Ontario. Head office, Toronto. Capital stock, $200,000, in 2,000 shares of $100 each. The directorate is made up of Alexander McArthur, merchant; Reuben Millichamp, merchant, and George Alexander Shaw, lieutenant-colonel, all of Toronto.

The Kramer-Irwin Rock, Ashphalt and Cement Paving Co., (Ltd.)—Gives notice that application under the Ontario Act will be made for incorporation, to make, lay and repair all kinds of flooring, pavements, roofs and walks, in the Province of Ontario. Head office, Hamilton. Capital stock, $10,000, in 2,000 shares of $500 each. The applicants are: Herman Kramer, paver, Buffalo, N.Y.; Thomas Irwin, John Thomas Irwin, roofer; Wm. James Kingdon, clerk; and John Franklin Monck, all of Hamilton.

The New Toronto Natural Gas and Oil Co.—Which was recently organized by Toronto and Ottawa people, has had most satisfactory results in the two wells sunk—one at each of the above places. The first well was drilled at New Toronto, to a depth of 1,300 feet. The first gas was struck at 575, and the largest body at 875 feet. At 1,300 feet the well was exploded and has been flowing at the rate of from 75,000 to 100,000 feet daily. The gas has been used by a factory alongside, for heating, lighting, etc., and the pressure seems to be gaining considerably from time to time. The second well, at Mimico, was sunk 1,100 feet, and the output from this time, from 300,000 to 350,000 cubic feet daily. A third well one and a half miles further west, has been started. A large area of land has been leased, and ten or fifteen wells will be sunk within a radius of 8 miles from the city. Experts claim that the big gas belt lies in the near vicinity, and, while neither wells are "gushers," yet they will more than repay the cost of sinking them. $10,000 so far has been expended, and a similar amount will be used during the next three months. The stockholders, who include a number of Ottawa gentlemen, are more than satisfied with the results, and look to a bright and prosperous future for the undertaking. The gas is of a high quality and absolutely free from sulphur, and its close proximity to the city makes the manufacturers and real estate men of Toronto hope for satisfactory results.

New Vancouver Coal Mining and Land Co., (Ltd.)—The annual general meeting of this company was held during the month at the offices, 12 Old Jewry Chambers, London, E.C., Mr. John Galsworthy, presiding. The directors, in their report, stated that the net output for the half year was 204,890 tons, and the sales 202,350 tons. Prices, which up to the middle of the year were fairly remunerative, fell considerably and continuously, so that the accounts showed that the working for the past half year had been less satisfactory, and they regretted to say that the prospects for the present year were even less encouraging. The directors recommended the payment of a dividend at the rate of 1½ per cent. for the half year (free of income tax), making, with the interim dividend paid in December last, 4 per cent. for the year. In view of the indebtedness of the company to its agents and the prospects of the company's operations for the current year the directors regretted that they were unable to recommend a larger dividend. They were also desirous that outlay on capital account, especially in these depressed times, shall be curtailed as much as possible, and all endeavours directed to getting the coal that must be taken to market at as low a cost as possible. The report and accounts were unanimously adopted; the dividend was declared, and the retiring director and auditor were re-elected.

Quebec Asbestos Co., (Ltd).—Registered by H. O. Mellor, 27 Clements-lane, London, E.C., with a capital of £25,000 in £1 shares. Object, to carry into effect an agreement, made March 17, between G. White of the one part and this company of the other part, for the acquisition of certain asbestos-bearing properties in the township of Cleveland, Quebec, Canada, and to carry on business as miners and smelters in all its branches, whether for asbestos or other minerals. There shall not be less than three nor more than ten directors; the first to be elected by the signatories to the memorandum of association. Qualification, £250. Remuneration 10 per cent. of the net profits, the same to be divisible.

Meeting of the Sydney and Louisburg Coal and Railway Co., (Ltd.)—The thirteenth ordinary general meeting of this company took place last month at London, Mr. G. W. Medley presiding. In moving the adoption of the report, the chairman said during the past year they had raised 170,863 tons of coals, against 155,907 tons in 1890, and 121,660 in 1889. That was the largest quantity ever raised by the company, and under ordinary circumstances they would have had very good profits to show, but owing to causes which he would explain to them the anticipated profits could not be put into the coffers of the company. They had disbursed, in the first place, for general repairs and constructions an amount of £1,328 owing to damage caused to the Sydney pier through an impact of ice. There had also been an increase in wages of £1,200, for a demand had been made by the miners of Cape Breton, asking for 15 per cent. increase, or at the rate of 3d. per ton; but they had, after negotiations, consented to accept an increase of 7½ per cent. or 1½d. per ton. There was also an item of £439 for new piping. The year's revenue account had, moreover, to bear a charge of £1,968 under the heading of depreciation, being one-third of the cost of the stone drift, new coal cars, and of payments on account of the new coal area, and £845, one-third of the cost of opening up the Emery mine, the payment for which was spread over three years. The year's working showed a credit balance of £1,120 13s. 11., as against £1,715 9s. 6d. in 1890, which, with the balance of profit and loss account brought forward on 31st December, 1890, and added to the £1,120, left an available balance of £1,675. Out of that sum the directors proposed to pay a dividend of six shillings per share, equal to 5 per cent., leaving to be carried forward a balance of £175. Mr. J. G. Mills seconded the adoption of the report, which was agreed to.

South Forks Hydraulic and Mining Company.—A charter of incorporation under the "Companies Act of 1890" (B.C.) has been granted to this company. Capital, $150,000, in 150,000 shares of $1 each. Directors: John K. Barker, W. Polleys and John R. Smith. Head office: Quesnelle Forks, B.C. The objects for which the Company is formed are:—Hydraulic or other process or processes of mining; to own and construct ditches, flumes or other systems of water-ways; to purchase or otherwise acquire, own, operate and sell or lease mines, minerals, water and water-ways; to do and perform all such other acts and things as are incidental or conducive to the attainment of the above objects, or any of them.

Whiteburn Gold Mining Co.—The property of this Company, consisting of 105 gold areas, 10 stamp mill and other machinery and buildings was put up at Sheriffs' sale, at Whiteburn, in Queens Country on 8th inst.

Homestake Mining Company of Ontario.—At a meeting of this company held lately, D. L. Mather was elected president and J. M. Savage Secretary-Treasurer. Mining has been begun on their claims. The company has lately secured in addition to its other properties, location 232 P. situated on Yellow Girl Bay, Lake of the Woods. The property was discovered in 1882. The originators of the company claim that the presence of a large body of rich ore has been demonstrated by the tests made.

Ontario Mining Co.—At the annual meeting held at the offices of the company in Winnipeg lately, A. G. McMicken Winnipeg, was elected president and J. S Ewart, Winnipeg, vice-president.

Bell's Asbestos Company Limited.—The directors have declared an interim dividend of 2s. 6d. per share (free of income-tax) for the half-year ended 20th June, being at the rate of 5 per cent. per annum, payable by warrant on and after the 15th inst. to the shareholders on the register on the 14th inst.

The Minerals of Ontario.

AN ADDRESS BY MR. A. BLUE, DIRECTOR OF MINES, TORONTO, TO THE STUDENTS OF UPPER CANADA COLLEGE, MAY 6, 1892.

It is about thirty years, since, in a country school section in one of the Lake Erie counties, I gave my last talk to boys and girls. Never much gifted in that way, I feared to trust myself to make an oral address in a room of College boys; and especially upon a subject that demands care in the statement of facts. Therefore, I have thought it wise to speak to you from paper.

Thirty years is a long time in the life of a man, as the life of man goes; a long time to be spent in well or ill doing. In that school section where I taught a generation ago, I am reminded that there were forty-eight or fifty persons each of whom had then reached my present time of life, or over. They were men and women in the vigor of their days and strength, who had cut for themselves homes out of forests of oak and maple, and walnut and chestnut, and a hardier or healthier lot of men and women you could not find in the whole of broad America. Where are they to-day? The answer is the old, old story. Of all but two of their number it has now to be said that there are other toiling hands where theirs have ceased from their labors, and there are other weary feet where theirs have completed their journey. It is the old, old story. "One generation goeth and another generation cometh; and the earth abideth forever."

You have read of Waterloo, an event of seventy-seven years ago. You recall the brilliant cavalry attacks of Marshal Ney upon Wellington's Fifth Brigade, and Wellington's unleashing order at sunset when arose that stern and appalling shout which the British soldier is wont to give upon the edge of battle, and which no enemy ever heard unmoved. In that Fifth Brigade which withstood and repulsed the charges of Marshal Ney's horse, and joined in the shout when the order to advance was given, was an Irish soldier, Maurice Shea, one of the 24,000 of English, Irish and Scotch who shared in the glory of that fateful day. Maurice Shea was the last survivor of the 24,000, and his death at the age of 97 took place a few weeks ago in the town of Sherbrooke, in the Province of Quebec.* A few days later there died in France the last survivor of the marines who fought and lost under Villeneuve off Cape Trafalgar. Eighty-seven years—nay seventy-seven years—is a long time in the life of a man, and such last survivors as those of Waterloo and Trafalgar are not often met with in human annals, so fleeting is our stay upon this world's stage.

In his book on Nineveh and its Remains, Layard observes that a deep mystery hangs over Assyria, Babylonia and Chaldea. With these names, he says, are linked great nations and great cities dimly shadowed forth in history; mighty ruins in the midst of deserts, defying by their very desolation and lack of definite form the description of the traveller; the remnants of mighty races still roving over the land; the fulfilling and fulfilment of prophecies; the plains to which the Jew and the Gentile alike look as the cradle of their race. For six centuries Nineveh was one of the great cities of the East, or perhaps it might more accurately be described as a group of cities. It was the capital of a great empire, in which a series of palaces surrounded by great and high walls had been built by successive kings. It was a city of about three days' journey, according to the prophet Jonah, or of sixty miles circumference, according to the old geographer Diodorus; and it had a population computed to be not less than 600,000. Nineveh perished with the last Assyrian king 2,500 years ago, and from that time until the explorations of Botta and Layard were commenced, fifty years ago, its place on the world's map was blotted out. Having been abandoned by man, its palaces and walls were gradually buried under the fine yellow dust which in the course of centuries the wind had drifted over them. Xenophon, who commanded the retreat of the Ten Thousand, encamped upon the site of the city without knowing its name. When the battle between the Romans and the Persians was fought within sight of the mounds in the seventh century of our era, "the city, and even the ruins of the city had long since disappeared," as we are told by Gibbon. And about 125 years ago the traveller Niebuhr, father of the historian, passed over Nineveh without perceiving it; he mistook for a ridge of hils the dust-covered rampart of brick and earth.

Then there is Troy, the old Troy of your Homer, if you read old Homer here. That city was taken and burnt by the Greeks more than 3,000 years ago, and its place on the map has been a subject of contention with scholars down to a period of less than ten years ago. "The question is now decided for ever," Dr. Schuchhardt tells us. "On the hill of Hissarlik Dr. Schliemann has uncovered the ancient palaces of Troy, has laid bare its colossal fortifications, and brought to light its treasures of gold and silver. Moreover, in the country round about, his unwearying exertions have proved the accuracy of many details, which show a coincidence, astonishing even to the most credulous, between the picture unfolded in Homer and the one preserved to this day."† The mound of Hissarlik is shown by Dr. Schliemann to be the remains of seven successive cities, one built over the ruins of another, and the second of which was the Troy of Homer. The first lies on the virgin rock, 115 feet above the sea, while the full height of the hill at the beginning of the excavations was 162 feet. The second is separated from the first by a layer of debris eight feet in thickness, covered by a layer of soil nearly two feet in depth, which proves that the site had been deserted and not built upon for a long time. The walls, the towers, the palaces, the pottery, and the gold and silver cups and bowls and vases and ornaments uncovered in the second city are remarkable evidences of its strength and civilization, and fully justify the observation of Dr. Schliemann in his last report that only after he had cleared the walls and excavated beneath them was he able to fully understand how long the duration of this settlement had been, and for what centuries its golden era must have lasted. He was able to verify in many particulars the accounts of Troy given by Homer, as traced in the records of the ruins, not the least important of which is the fact so curtly told in our primers that "Troy-was-burnt," the proof of which he found in the charred beams and the vitrified brick of its walls. And he was able also to establish this further fact, to quote Schuchhardt again, that "there existed on the site of Hissarlik, at a period far anterior to any we know of on Greek soil, a proud and royal city, mistress of sea and land; and the singers of the Trojan war, just as they were familiar with Ida and Skamander, with the Hellespont and the Isle of Tenedos, knew also of this city, knew of its golden age and of its mighty downfall."†

I have said this much by way of preface in the hope of giving you some idea of the lapse of time as we find it in the annals of human events. What it means when we come to consider the history of the earth itself, how we measure the time of geologic events, we can hardly conceive, much less determine. The brick in the walls of this building was made out of the brown clay of the Drift age, Saugeen clay of the geologists, which you find extending over a wide area of the province, underlying the humus or vegetable mould and perhaps a few feet of gravel or sand. It is as old as the glacial era, or the closing period of that era, and doubtless older than our great lakes as they now exist, and very much older than our forests. But after all it is only the product of older rocks, of the granites and clay slates of the Huronian and Laurentian areas, ground to dust by glaciers, or decomposed by the action of water and weather, or dissolved by carbonic acid in a moist atmosphere. Much older is the lime in the plaster of the walls, the material of which we get at the nearest point from the Niagara group of rocks, whose aggregate thickness in places is not less than 150 feet. Whether built up by the encrinites whose forms are so plentiful in the upper beds, or by the deposition of calcareous matter chemically separated from the primary rocks in the ancient seas, or as seems most likely, by both these agencies working together, the process must have occupied thousands of years. Still more ancient is the brown sandstone used in the foundation of your building, taken from the upper beds of the Medina formation, near the base of the Niagara escarpment. Where this stone is quarried at the Forks of the Credit the Niagara limestones overlie it to a height of nearly 200 feet; and this sandstone, like the limestone and the clay, is material reworked from the primaries. Very much older than the clay or lime or sandstone are the slates on the roof. The slates we use here are obtained for the most part from the Province of Quebec or the State of Vermont, where they occur in the so-called Quebec group of rocks in the Lower Silurian system, but which is probably of pre-Cambrian or Huronian age. We know that the best slates are found among ancient lavas and rocks which have been faulted and tilted, and we have reason to believe that they have been formed under the influence of great pressure and heat. In this Province if slates of good quality and cleavage exist at all they will no doubt be found in the Archæan formations of the north, and explorers report their discovery there. On Temagami lake and the Matabechawan river there is said to be enough to supply the continent—but the stories of explorers must be received with a grain of salt.*

But if the sandstones, limestones, and clays of which the walls of this college building have been constructed are old, what is to be thought of the age of those primary rocks out of whose ruins they were brought, and worked over grain by grain, and slowly laid down again by the waters of the sea in new beds removed by hundreds of miles in distance and by eons of years in time from the parent bodies? And what is the life of man compared

To be continued.

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*Since this was written, I have seen a letter by A. B. Powell, in the London *Free Press*, which tells of another last survivor of Waterloo—William Chambers, of Dresden, in the County of Kent,—who not only fought at Waterloo, but went through the whole of the Peninsular war. Mr. Powell says that Mr. Chambers was born in the County of Antrim, Ireland, on the 12th of September, 1787, and is, therefore, in the 105th year of his age. "He can carry on a conversation with much strength and intelligence, and gives a most vivid description of his life in the army." He came to Canada in 1831.

†Schliemann's Excavations, an Archæological and Historical Study, by Dr. C. Schuchhardt, p. 18.

†*Ib* p. 92.

*This reminds me that after the Mining Commission had taken the evidence of Sir James Grant at Ottawa, the witness volunteered a piece of wholesome advice. "You must be very careful, Mr. B." Sir James said in his deliberate Scotch way, "of what these mining men tell you; they are so prone to exaggerate." "Yes," I said, "I have no doubt David had them in his mind's eye when he made that hasty remark. You know David prepared a hundred thousand talents of gold, and a thousand thousand talents of silver, and brass and iron without weight, for the building of the temple; and when he said in his haste, that all men are liars, I sometimes suspect that he had before him his experience with the mining men of his day." Sir James thought so too.

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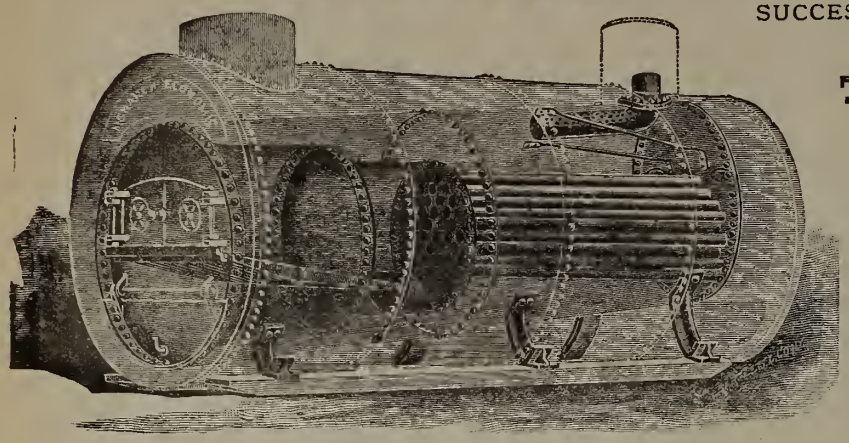

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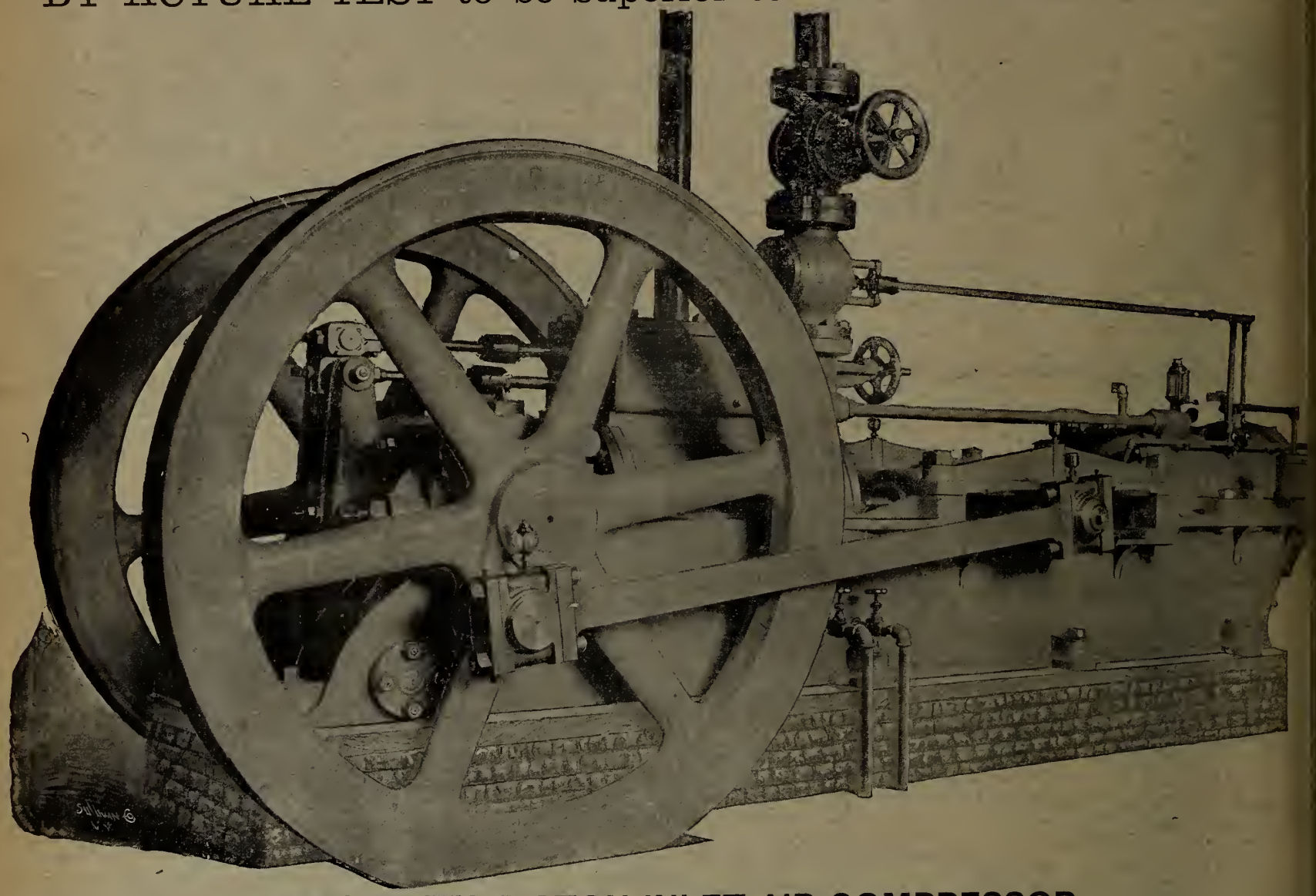

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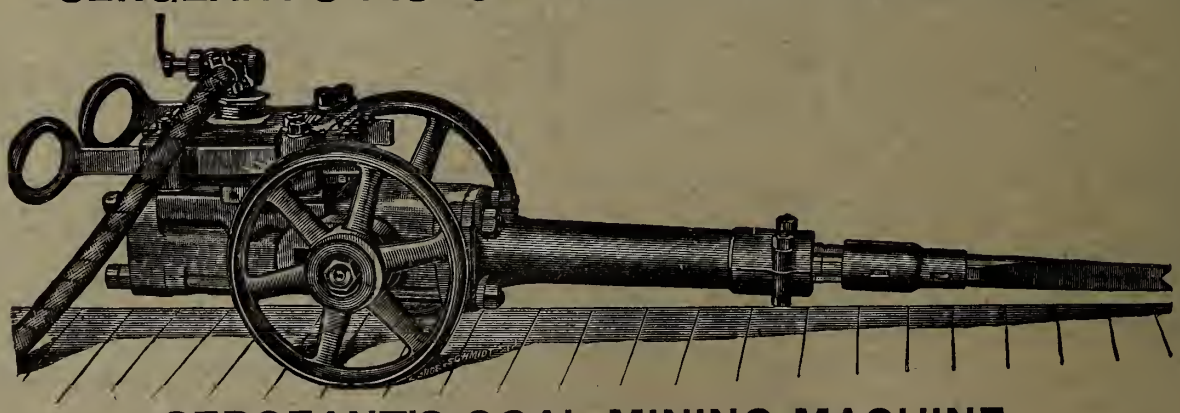

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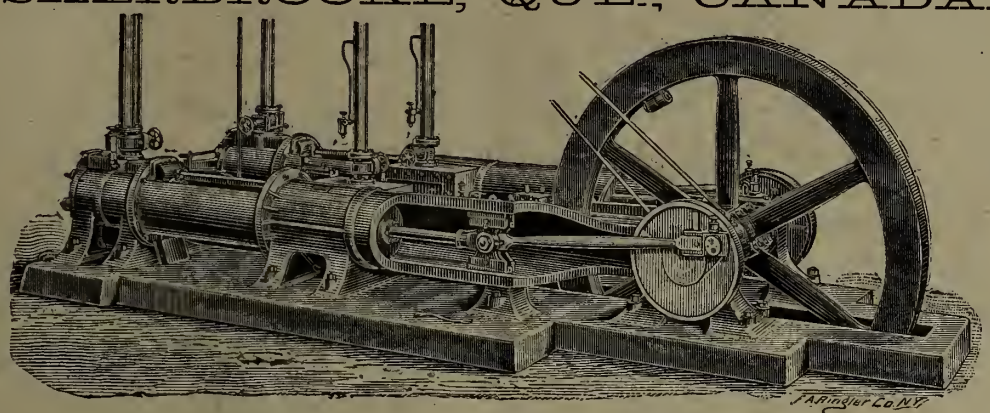

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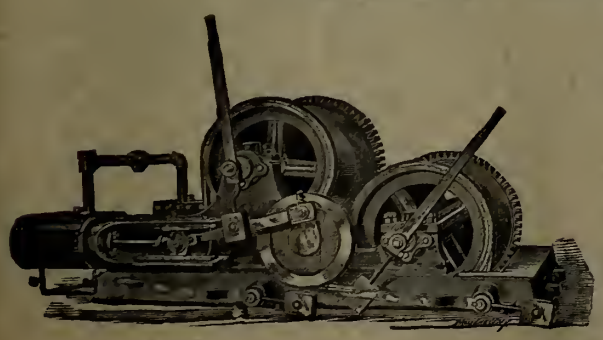

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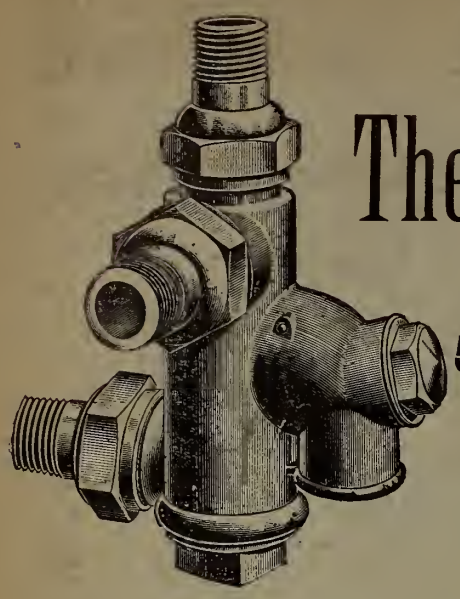

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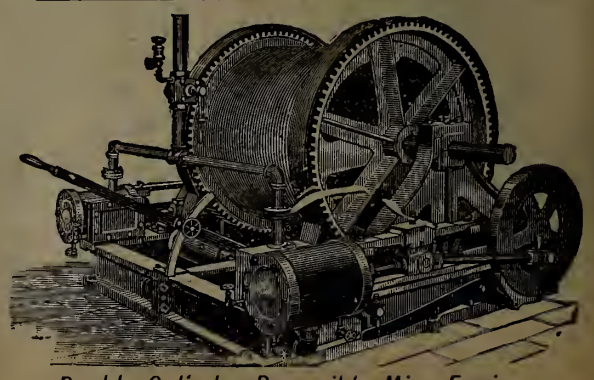

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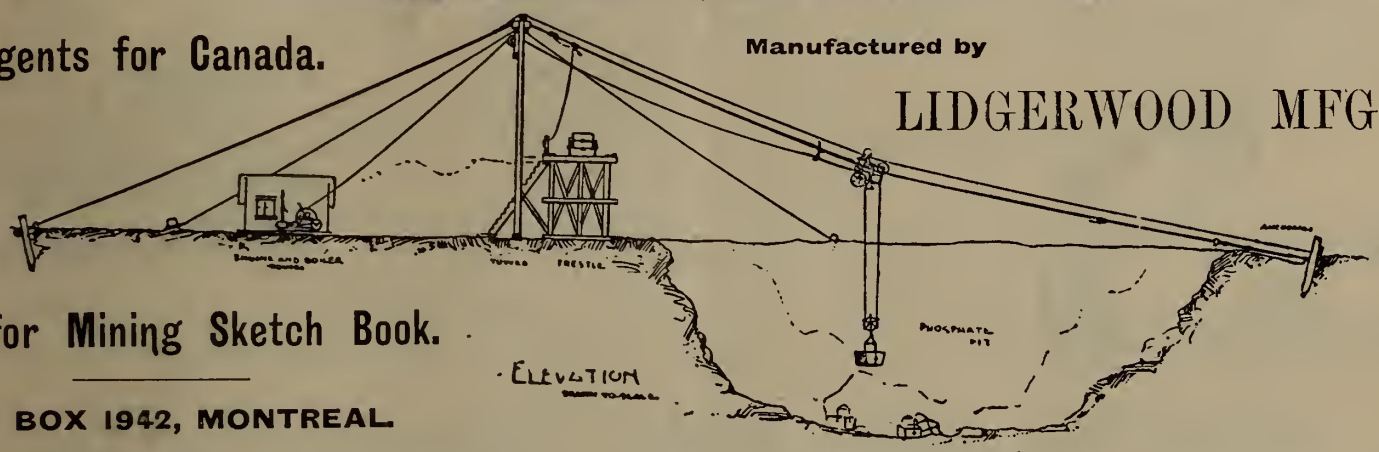

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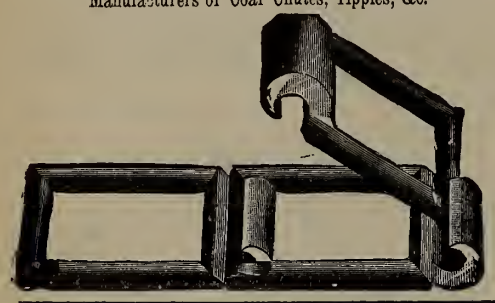

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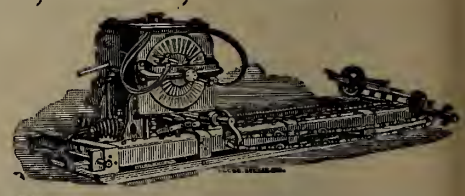

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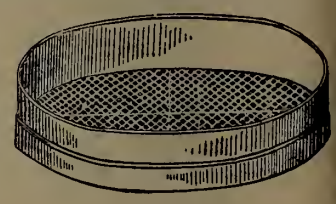

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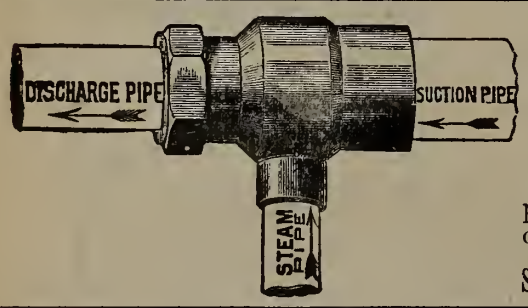

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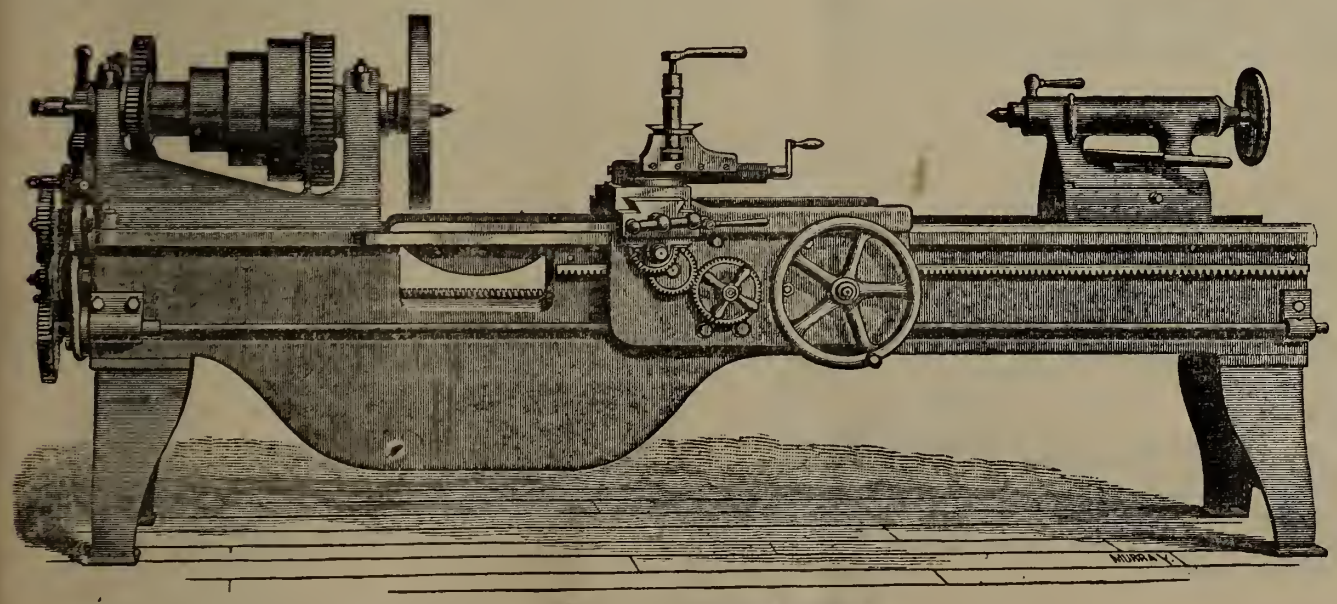

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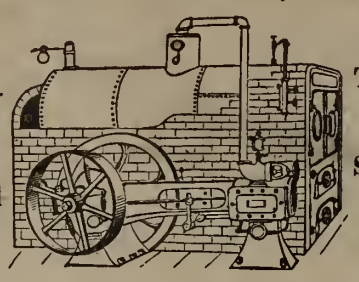

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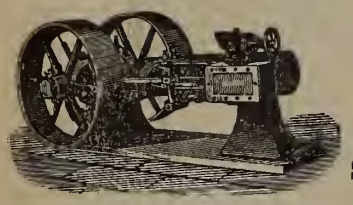

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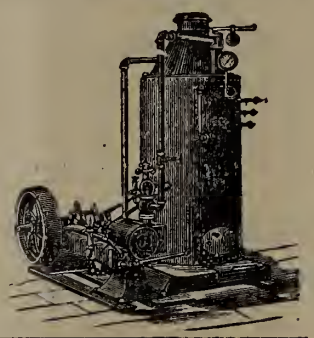

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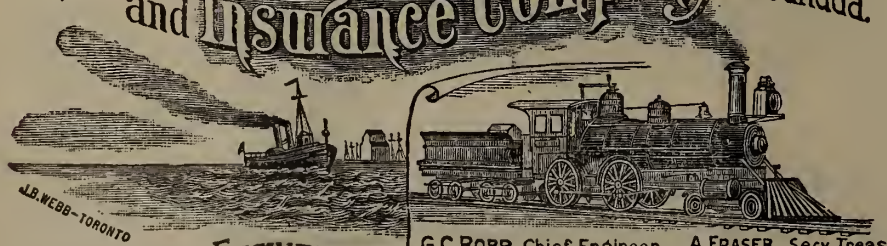

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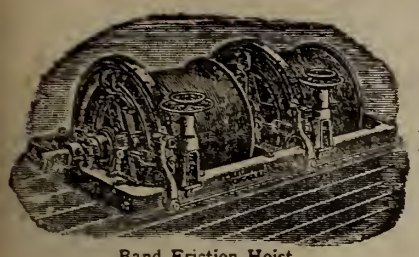

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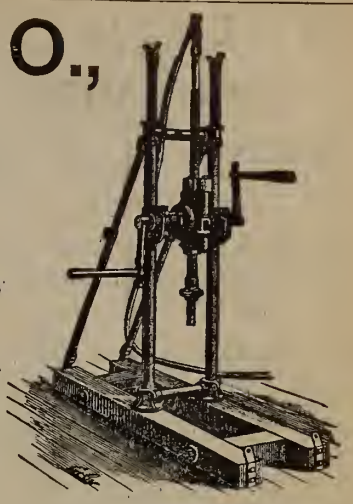

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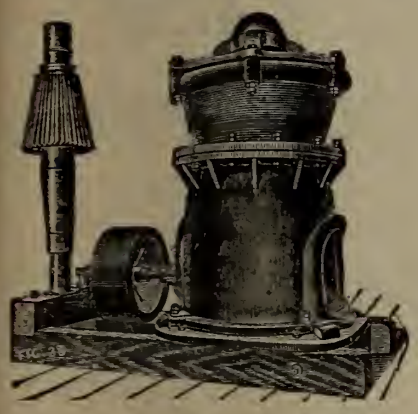

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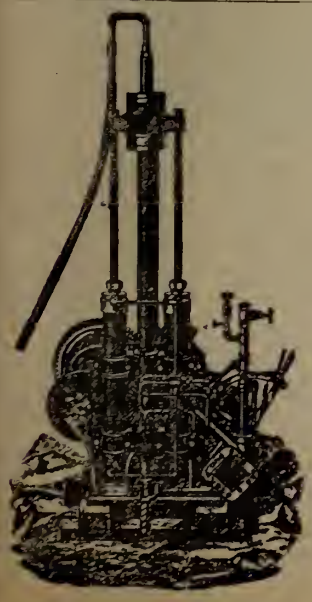

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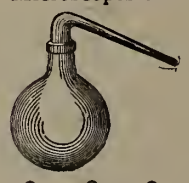

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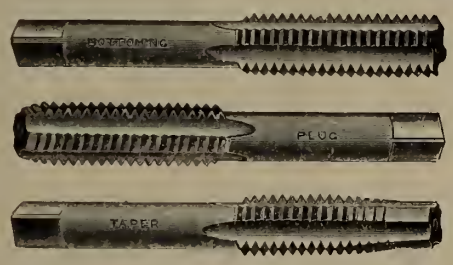

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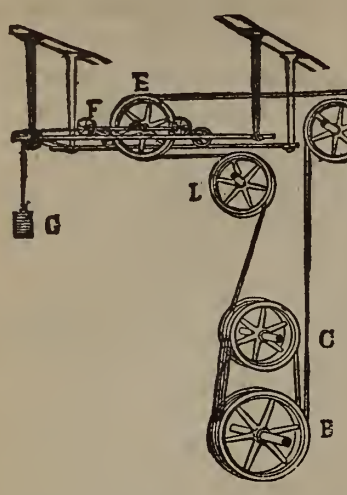

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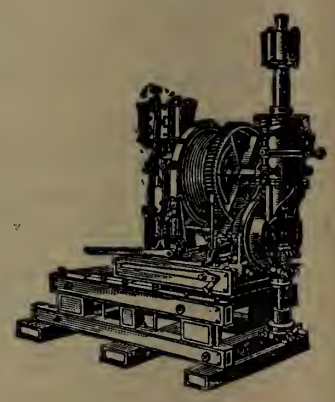

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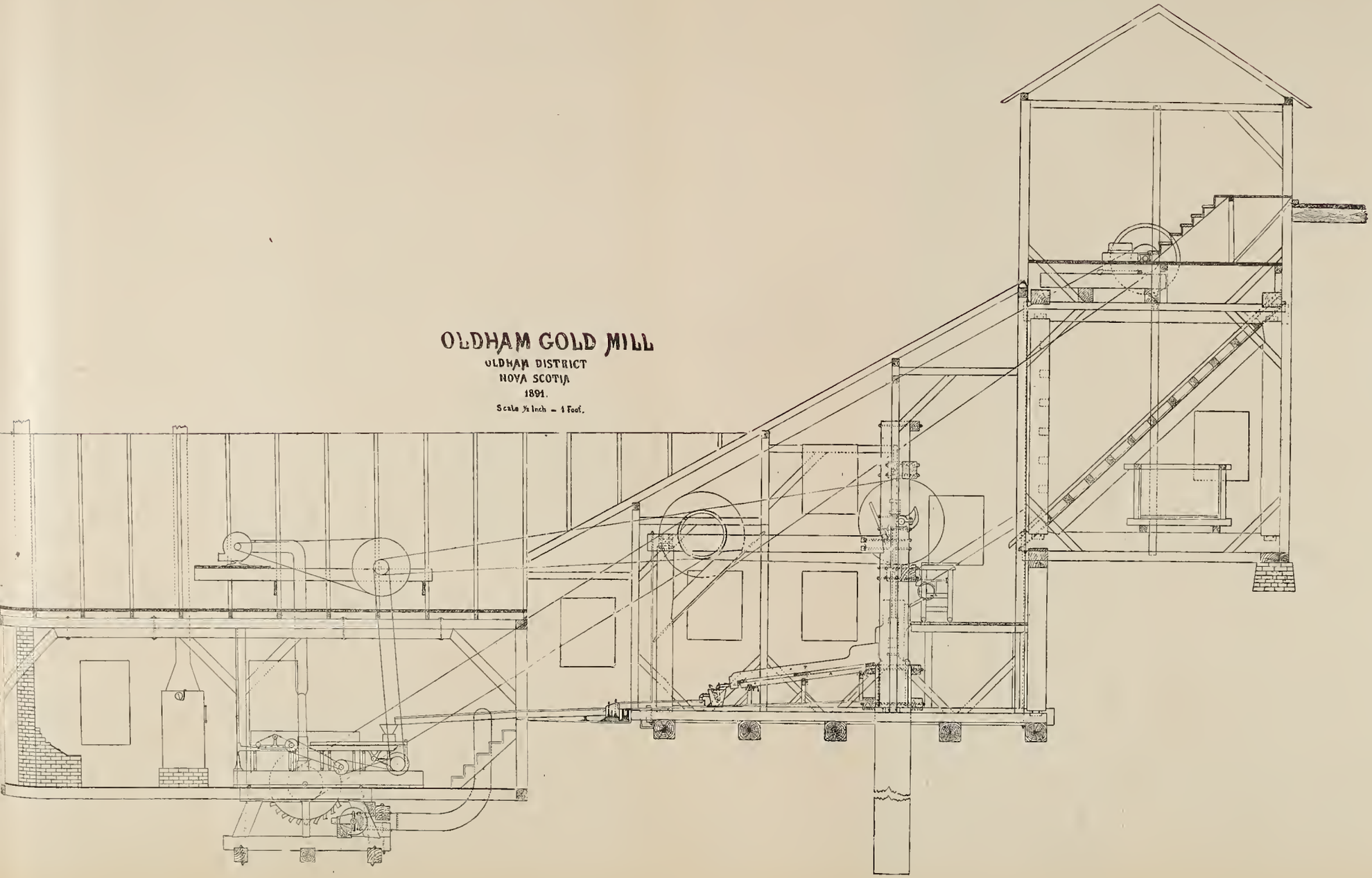

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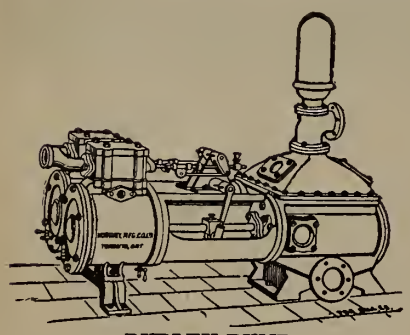

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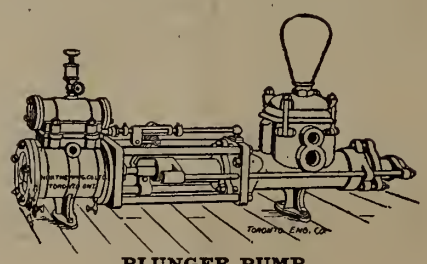

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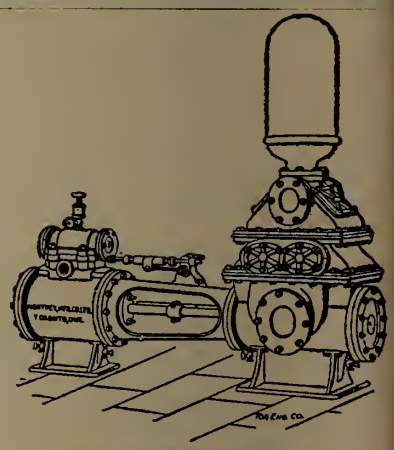

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THE following Resolutions of Council indicate beyond a peradventure the status of THE REVIEW as the exponent of the Canadian Mineral Industries :—

The Gold Miners' Association of Nova Scotia.

"At the annual meeting of the Gold Miners' Association of Nova Scotia, held at Halifax on 6th March, 1889, THE CANADIAN MINING REVIEW was adopted the official organ of this Association.

(Signed), B. C. WILSON, *President.*
G. J. PARTINGTON, *Secretary.*

The Mining Society of Nova Scotia.

"Moved by Mr. R. G. Leckie, seconded by Mr. C. A. Dimock, That the thanks of the Society be tendered to Mr. B. T. A. Bell for his kind offer placing the columns of THE REVIEW at the disposal of the Society; and that THE CANADIAN MINING REVIEW is hereby appointed the official organ of the Society."

(Signed), H. S. POOLE, *President,*
H. M. WYLDE, *Secretary.*

The Asbestos Club, (Quebec.)

"Resolved: That THE CANADIAN MINING REVIEW is, by authority of the Members and Council, hereby appointed the official organ of the Asbestos Club."

(Signed), D. A. BROWN, *President.*
A. M. EVANS, *Secretary.*

The General Mining Association of the Province of Quebec.

At a meeting of Council held at Montreal on Friday, 6th May, 1891, it was moved by Captain Adams, seconded by Mr. R. T. Hopper, and resolved: That THE CANADIAN MINING REVIEW be the official organ of the Association.

(Signed), GEORGE IRVINE, *President.*
B. T. A. BELL, *Secretary.*"

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Vol. XI. AUGUST, 1892. No. 8.

Would Reciprocity in Coal be Beneficial?

A pamphlet has recently appeared entitled "Reciprocal Coal with Canada would give the New England States Cheaper Fuel. By D. J. Kennelly, Reciprocationist." Mr. Kennelly is a well known gentleman in Cape Breton, who is stated in the report of the Department of Mines, Nova Scotia, for 1890, to be "agent and manager of the Sydney and Louisburg Coal and R. R. Co., Ltd." He is fairly entitled therefore to be acknowledged an authority on the cost of Cape Breton coal, and fully competent to give figures bearing on the charges of delivery to present and prospective markets. His object in writing the pamphlet seems to be to prove that Cape Breton coal can be delivered in Boston—in view of the adoption of recent improvements in the means of transporting and handling of coal—at less cost to the consumer than he is at present supplied by the home producer of coal, and this cost is *inclusive* of the present duty, 75 cents per ton, on Nova Scotia coal. This is undoubtedly a very important assertion, and one which cannot but be highly gratifying to the coal operators generally of Cape Breton; for it may be fairly assumed that the circumstances of mining, position, quality of coal, etc., are not so diverse as to exclude any of the mines from participating in the advantages of a largely consuming and doubtless profitable market; this last, but most important item, *profit*, being, we may rest assured, a not forgotten factor in Mr. Kennelly's statement of price of Cape Breton coal F.O.B.

With some adroitness, Mr. Kennelly places in comparison, the cost of Cumberland coal, shipped at Baltimore and Philadelphia, and delivered at Boston in 1890; and establishes by his figures an advantage to the consumer of 67 cents per ton in favor of Cape Breton coal. This, too, it must be remembered, is *inclusive* of the duty of 75 cents per ton.

Two most interesting inquiries arise in connection with this statement of Mr. Kennelly's. One is of a practical character, viz: have any of the coal merchants or consumers of coal in Boston and adjoining localities availed themselves of the opportunity of saving 67 cents per ton? The other is in the sphere of politics, and presents itself in this form: if Cape Breton coal can be delivered in Boston at the price stated and with the saving named to the consumer, surely the latter can afford to pay the duty, and why therefore should the United States government remove it? It is an advantage all round—the consumer saves money, and the government earns a revenue that would be of an increasing character as the Nova Scotia imports increased, which they may be surely expected to do under such favorable circumstances as are represented.

With respect to the first of these queries, we have to confess to our having received a chill in making enquiry in the States as well as Cape Breton, and being unable to learn of the existence of any boom in the coal trade in the direction reported. We would be pleased indeed to have the knowledge and the opportunity to disseminate it, that Nova Scotia, nay we will say, that Cape Breton coal only, had forced itself by intrinsic merit, and the accompanying favorable circumstances, on the wants of New England, and become firmly established as the cheap fuel of that part of the States.

In regard to the second query, it has a very important bearing on the protection policy of both Governments—the United States and the Dominion. Assume a mutual abandonment of duty on coal, this would doubtless be, in the circumstances named, a great boon to the American consumer of Nova Scotia coal, for, according to Mr. Kennelly's figures, the total saving to the consumer would in that case be 67c. + 75c. (the duty) = $1.42 in favor of Cape Breton coal.

Is this not too good to be true? Is it a realizable result in the coal trade of Nova Scotia? We do not question the accuracy of Mr. Kennelly's figures; we are pleased to note the details of charges, evidencing care in making the statement of cost of Cape Breton coal, but we cannot fling aside the lasting fear in our mind that there must be something more than cost that affects the question and operates to the disadvantage of the Nova Scotia coal operator, and is a set off against the saving in price adduced by Mr. Kennelly. Is this at present unknown term in the equation of more or less value than the duty of 75c? Would the removal of the duty throw the balance of gain in favour of Nova Scotia coal? We pause for a reply.

Dobson and the "Critic."

The Halifax *Critic* most ungraciously and in very bad humour owns up at last to having boomed a first-class fraud. In its issue of 5th instant it refers to C. M. Dobson thus: "Mr. Dobson did promise to send the *Critic* a full defence of the charges, but when it arrived we found that he admitted having made use of the A.R.S.M. without being entitled to it, and as we consider this an unpardonable offence in a professional man, we concluded to drop the matter . . . but we now, while giving publicity to his defence, desire to recall any complimentary remarks we may have made in regard to him." Then follows a long and characteristically brassy effusion from the pen of the notorious Charles Miles De Tracey himself, from which in the opening sentences we quote:

"He accuses me of having used the A. R. S. M. degree, and I may say and do say, as much as I regret it and have regretted it, that while a very young man, scarcely more than a boy in fact, I was indiscreet enough to claim the same and print it on a card at the time, certainly not realizing the gravity of the indiscretion and how it might react upon me in after years. It was against all the ethics of a scientific man to do so. I regret it, I have regretted it, but does this one error of a young man's life occasion such articles or justify such articles as were published at Ottawa. I find now, *five years after*, that my stupidity has been stored away against me, and at the brightest time of my life "sprung" in the public press, with all the venom and maliciousness that jealousy and professional hatred could conjure, coupled with outrageous libels full of glittering generalities, no specific charges, but on general principles, for which, please God, I will hold the writer sooner or later legally or physically responsible, and be thankful the laws of the United States are so broad and just in cases of this description."

A youthful indiscretion indeed! Yet in 1886-7-8, only four years ago, when parading the A.R.S.M., he advertises to the world that he has had no less than

"Ten years PRACTICAL experience at the largest Galena mines in Great Britain (Foxdale, Isle of Man), and on the South and West African Gold mines—Lisbon-Berlin (Gold), Kimberley (Diamond), and Gold Coast (Gold) mines—and on Canadian Phosphate and Mica mines."

(*Vide* his card in April issue.)

To this glittering repertory our Annanias now adds (*vide* the *Critic*):

"Experience in Canada, 1886, '87, '88, including the Sudbury and Marmora mines; opened and explored the magnetic deposits of N. E. Georgia successfully, 1889; Experience at the St. Genevieve Copper mines, Missouri, 1889; Cuba copper mines 1889; appointed Superintendent Rico Colorado Metallurgical Reduction works, San Juan, Colorado, 1890 (wet and dry crushing and leaching), condemned them owing to R. R. coming in; experience in the Leavenworth mine, Central City, Colorado, 1890; General Supt. Coal Hill and Spodra coal mines, capacity 400 tons daily; 200 men employed; Cholean air machines, pillar and breast workings, product to the Missouri Pacific R. R. 1890. Resigned after breaking through successfully into old workings with 40 acres of water above us. Reason for resigning couldn't agree with owner's brother. Experience on the San Sebastian mines, Salvador, Central America, 1891; Experience in Manganese; Virginia, 1891; Georgia, Whitefield Co., 1888; Etowah, 1889; New Brunswick, 1892; Nova Scotia, 1892, gold. Nickel silicates, Oregon, 1892; California gold, 1892; Mexico, 1890; lead and zinc mines of S. W. Missouri, 1892."

And it is with such self-evident rubbish the *Critic* fills up space!

One can best appreciate all this brazen-faced parade of vagary when it is remembered that beyond some crude prospecting and miscellaneous reporting, Dobson's mining experience

in Canada during the years 1886-7-8 was absolutely nil; neither in the Maritime Provinces nor in Upper Canada has he ever been engaged in any mining operation worthy of the name. He denies having carried falsified credentials from John Taylor & Sons. Again we repeat he deliberately states an untruth. These forged letters *we read* in 1886, and the statements contained therein as to his ability were the means of our introducing him to some professional work. The report on a mineral property which he then prepared for one of our readers is fyled in this office, and is the best evidence of how little he really knew. With unblushing impudence he would fain cast aspersions on the personality of the REVIEW by reciting some ancient history as to its antecedents six years ago, all of which is stale news to our readers; but he carefully avoids any mention of the *deliberate theft* of personal property from the office of Mr. J. A. Gemmill, Barrister, of this city, or the *fraudulent affidavit* sworn to in the Crown Lands Office, Toronto, whereby he fleeced Mr. J. E. Thompson, of that city, out of several hundred dollars, or the *persistent deception* practiced while posing as an analyst and mining expert in Toronto, not to speak of the great multitude of debts to boarding house keepers and tradesmen all over the country. These are not "glittering generalities" but very serious charges, which we are prepared to substantiate whenever Dobson cares to bring us to the proof. But one word more—the last free advertisement Dobson will ever get from us. In his letter to the *Critic* he says: "With this money I went to Toronto, leaving debts of about $50 (?) behind me, some of which have since been paid (?). I got work at my profession and gained *some prominence*. Vide MINING REVIEW, February, 1889." As a matter of curiosity we turned up the fyle containing this issue, and on page 18 read:

"We learn on good authority that C. M. De Tracey Dobson, an individual styling himself a mining expert, and who has recently been posing very prominently in this capacity in the Toronto press, has departed to a more congenial clime. The many and varied peculiarities which have distinguished this party's career since he first made our acquaintance some three years ago would prove most interesting reading, had we space to give it in detail. It is sufficient to add that his departure from Canada is a positive gain to the mining community. Chicago papers please copy."

EN PASSANT.

At the meeting of the Mining Society of Nova Scotia, to be held at Londonderry next month, papers will be read by Mr. R. G. F. Leckie, son of Mr. R. G. Leckie, General Manager of the Londonderry Iron Company, and by Mr. John E. Hardman, Oldham. After an inspection of the works of the Company, the members will take the evening train to Truro, where a programme for their reception and entertainment is being arranged. A full report of this meeting will be given in our next issue.

Reports from Europe do not indicate any change in the price of phosphates. Producers are not sanguine of any material advance before next Spring.

Mr. Walter B. M. Davidson, F.G.S., A.R.S.M., of London, England, has returned to Ottawa from a visit to the mining camps of British Columbia. Mr. Davidson, it is understood, was engaged by Lord Aberdeen to examine and report on his lordship's properties in the Okanagan district. His views on the present condition and future prospects of the mining industries in the West Kootenay mining district, published elsewhere in this issue, will be read with interest.

In view of the suspension of operations at many of the mines, incidental to the stagnation of the phosphate market, the proposed excursion of the members of the General Mining Association of Quebec to the Lièvres river has been reluctantly postponed. A general meeting of the Association will, however, it is expected, be held at an early date, in Montreal, to receive and consider the report of Council anent the proposed united Mining Convention.

On the 25th ultimo a deputation from the General Mining Association of Quebec had the honor of an interview with the Hon. the Minister of Agriculture and Dr. William Saunders, Executive Commissioner to the World's Fair for the Dominion Government, with respect to Quebec's mineral exhibit at Chicago. It was pointed out that the grant of the Quebec Government—a paltry $12,000 to cover the whole exhibit from the Province, was wholly inadequate for a proper representation of the great mineral resources of the Province, and the Dominion Government was urged either to make a special appropriation from its grant or to send the exhibit now in the museum of the Geological Survey at Ottawa. Some assistance from the Dominion Government will be necessary if Quebec is to be represented as it should be at the World's Fair, and it is hoped that the representations of the Association will have a satisfactory outcome.

In another place our readers will find some interesting notes from our correspondent on the Souris coal fields. Last year the Government of Manitoba made an agreement with the Canadian Pacific Railway to run to the Souris coal field. At the same time an understanding was also come to with the Dominion Coal Company to mine and place this coal on the local market on the completion of the railway. As a result, the first car of coal from the district arrived the other day in Winnipeg, and in a short time the Company will be prepared to supply the demand for this coal. The product is situated in a good locality, being accessible to connections with the branch railways in Manitoba south of the Manitoba North-Western Railway. The coal is therefore in direct connection with the most populous portions of the country. The open prairie districts of Southern Manitoba, where wood fuel is scarce, have now a convenient and abundant supply of fuel opened to them. The price of the new coal will be $4.00 on track at Winnipeg, as compared with the old price of $7.00 per ton for a similar coal, while at points nearer the mines the price will be even lower. This reduction in the cost of fuel will be of great value to Manitoba in cheapening the cost of living and reducing the cost of coal for manufacturing purposes.

Rumour hath it that one of our most popular field geologists, whose excellent work as a member of the staff of the Geological Survey is well known, particularly in the gold districts of Nova Scotia, will shortly be married to a charming French-Canadian lady of this city. The REVIEW bespeaks a hearty round of congratulations on the coming event.

The use of cyanogen, in its various compounds, as a solvent for the precious metals in so-called refractory ores, appears to be coming into more general use. That it will prove to be effective and economical on all such ores is not to be expected, but that it has a field for usefulness, which further careful experiment and practice will probably broaden, seems now to have been demonstrated by the continued monthly reports of the "South African Gold Recovery Syndicate," which is working the McArthur-Forrest cyanide of potassium process. The success in South Africa is greatest where the tailings from the oxidised ores near the surface are treated, the percentage of recovery in some cases reaching above 90. That the process will be equally successful upon some of the other classes of ores found there has not yet been demonstrated. Some doubt is entertained by competent authorities as to the validity of the parent company's patents, or any patents, in which cyanide of potassium is used as a solvent; the use of this salt for such purposes being of frequent mention in chemical and technical works long antedating the original Cassel Company's patents. For ourselves, we do not believe that the patents can hold in Canada. In situations where fuel is scarce and roasting would be expensive, this process, or a modification of it, will perhaps be adopted in lieu of chlorination, but if so, solely because of lessened expense, as the percentage of extraction now obtained by chlorination in the best establishments is very high and very regular. Mr. A. J. Colquhoun, representing the Gold and Silver Recovery Syndicate, Limited, of Glasgow, is now at Golden, B.C., and writes to say that he has been commissioned to visit our principal mining camps and report on the suitability of the ores for treatment by the McArthur process.

The Montague Syndicate (limited) is the designation of the new English company which acquired on 1st inst. the Annand group of gold areas, situate at Montague, N.S. The properties include the "Rose," "Montreal," and "Lawson" areas. No particulars of purchase price and capitalization are available up to date of going to press.

Mr. J. Lainson Wills, F.C.S., late General Manager to the General Phosphate Corporation (limited), has gone to the West Kootenay mining district, where it is not unlikely he may practice in the future.

The Legislative Assembly of the North-West Territories has under consideration a Mines Regulation Act. A mine inspector—it is hoped a properly qualified one—is to be appointed.

California papers state that John Hayes Hammond, the young mining engineer of California, has just declined an offer of $15,000 a year to take charge of the South African mines of a wealthy London corporation.

Notwithstanding that most of the Australian copper mines, and a large number of those in America, are either closed or being only partially worked, as the result of discouraging market conditions, the Japanese contemplate reopening a copper mine at Musashi, which was first worked 1,183 years ago. This ancient property is said to be spoken of in Japanese manuscripts of undoubted age and authority, and the galleries and levels are stated to be in some cases just as they were 700 years ago.

The latest of the many uses to which asbestos is being applied is in the formation of a non-conducting rest for flat or box irons. It often happens during ironing operations that the iron resting upon the ordinary stand is so hot as to scorch the sheet beneath, and not unfrequently it makes the stand too hot to touch. By employing a layer of prepared asbestos placed on top of a wooden stand these disadvantages are overcome. The stand does not get heated, the ironing-sheet is not scorched, nor is the face of the flat-iron liable to become scratched or soiled, as when a metal rest is used. The asbestos also, owing to its non-conducting properties, enables the flat-iron to retain its heat much longer than has hitherto been possible.

The report of the mine inspector for East Scotland for the past year states that there were 51,749 persons employed, raising a total tonnage of mineral amounting to 17,489,756 tons, with 80 fatal accidents, and 81 deaths Under the metalliferous Mines Act there were 733 persons employed, raising 198,713 tons of mineral, with three accidents and equal number of deaths. Of the total tonnage 14,763,193 tons were coal, and 143,639 tods ironstone.

At a recent meeting of the North of England Institute of Mining and Mechanical Engineers, Mr. J. B. Simpson, in an address on improvements in mining methods, said that a great item in the cost of working coal was that of its conveyance from the face to the shaft. In the majority of collieries this consisted of three distinct operations: (1) Conveyance from the face to the point where the main horse roads or self acting inclined planes end; (2) from the station to which the hand or pony putters had conveyed it, and the haulage thence by horses or self acting inclined planes to the engine plane landing; and (3) from the termination of the last haulage to the shaft by means of engine planes. Summarizing the cost of these three different haulages he gave it as 5d. per ton per mile. He feared he could not suggest in what way this could be cheapened; how far the application of electricity might affect any portion of the cost they had not had sufficient experience to judge, but no doubt ere long electricians would assist them in the conveyance of mineral underground both in economy and efficiency. The question of the transmission of power underground for the various purposes of pumping, hauling, coal cutting, etc., had of late occupied a foremost place, and recent papers had enabled them to see the great strides which the application of electricity was making. Compressed air for deep and fiery mines possessed great advantages, but its co-efficient of useful effect, being only about 30 to 40 per cent., and its heavy cost, militated against its general use. Steam conveyed down shafts was common, but was seldom applied for long distances. The question was of such importance that he would venture to suggest the appointment of a committee to investigate the chief systems (1) by steam, (2) by ropes, (3) by compressed air, (4) by electricity, (5) by petroleum and gas engines, and by other means. The substitution of machinery for the labor in hewing coal, although introduced many years ago, did not seem to have made much progress, but no doubt they might look forward to the lessening and cheapening of labor in drilling holes in coal and stone being possible when a general system of electrical transmission of power is adopted. The great quantity of coal consumed in the production of steam for the working of mines was a serious question; he estimated that about five per cent. of the total output was used in this way. In the defence it must be said, however, that inferior and small coal was frequently used. In colliery engines they had not made such marked progress as other branches of industry, where coal had to be purchased and other economy practiced. To ensure great economy, however, required in the first place a greater expenditure in the machinery put up. In mechanical screening great improvements had been made.

The Surveying of Mines.

At a recent meeting of the Engineer's Club, Cleveland, Ohio, Mr. J. L. Culley read a paper on the above subject, of which the following is an abstract:—In order to insure accurate work in the surveying of a mine the surveying party should consist of the engineer, a pilot or fore-sight, who goes ahead and selects the transit or angle points, two chainmen, a torch-bearer for the instrument and a backsight. The pilot should be familiar with all the mine workings, and the mine boss is therefore generally selected for this position. The hind chainman should be specially selected by the engineer, for the accuracy of the measurement depends upon his ability. The duty of the torch-bearer is to first light the plumb-bob, then the upper plate until it is level, then the vernier, then flash the cross hairs, and finally the vernier reading. In setting or reading the vernier the engineer should stand square to the vernier with the left hand on the upper plate, and should cause the torch-bearer to pass his light over the engineer's left hand to a point slightly above and to the right of the centre of the vernier. The engineer will then be able to read it without trouble.

The setting of the plates will be greatly facilitated if a small rosette be put on the outside of the lower plate directly under the 0·0 of the horizontal limb. Then to set the plate at 0·0 the engineer should pass his hand around the plate until the rosette is met and then bring it and the vernier at once together. Otherwise frequently several revolutions are made before the desired position is obtained. The flashing of the cross hairs is a very simple operation when properly done. Put the instrument in position, find the light and nail in front of it, then direct the torch-bearer to "flash" and he will pass the flame of his light directly across the telescope axis 2 in. in front of the object glass untill the cross hairs are in position. The position of the sight nail is more clearly defined if an ordinary surveyor's marking pin is held plumb over or in front of it. The sight lamp, nail and telescope should always be in a straight line. The angle having been obtained, the engineer notifies the chainmen to measure up to his position, then proceeds to the fore-sight, the back-sight takes his position and the fore-sight seeks a new point.

Ten years ago it was the universal custom to read and note all the angles as right or left. This is a very bad practice, as it is easy to put the entry in the wrong column and to forget to place the R or L opposite the figures. It is now the usual plan to make all the entries "right" from zero and to record them just as they are observed, even though they are as large as 359 degs. 59 min.

It is not allowable to abridge the underground work, but on the surface the operators only wish to know the location and direction of the most advanced works. This is often done by producing the first and last course of a survey to intersection and then calculating the necessary angles and distances.

As this is a very laborious process, the author has been to much trouble to devise a simpler one. After a most careful study, the following method has been adopted. An accurate map on a large scale, generally 40 ft. to 1 in., is made of the inside survey. All angles are laid off by ordinates, those less than 20 degs. by tangents, the balance by sine and consine and radius, with the radius not less than 10 in. There is no known protractor by which angles, for this purpose, can be successfully plotted. An engine divided paper protractor may and should be used to test every angle, and each course and set of courses that run in one general direction should be repeatedly tested by scale. When the plot thus constructed has been thoroughly tested certain convenient courses are selected and produced to intersection. The lines thus produced are then measured by scale, and the angles of intersection computed from the deflections of the intervening courses, and tested by protractor. This process will give absolute results as to angles and lengths for an entire survey within the fraction of a foot. This method also affords an opportnnity for a careful review, by plot, of the inside survey.

Whenever it is unavoidably necessary to use a short base in connecting the inside and outside lines in a shaft mine the following method is recommended for extending the base at both top and bottom of shaft:—Place, in the direction of the first course, a timber over the top of the shaft, 5 or 6 ft. above the ground if possible, and let down the two plumb-bobs from one edge af the timber at as great a distance apart as possible. When the plumb wires are at rest bring a tightly-drawn fish line 15 ft. long into the vertical plane of the wires and drive a stake at a convenient distance from either wire. Repeat the operation until the two points on the stakes are exactly in the vertical plane of the plumb wires. This is both quicker and more satisfactory than the usual operation of setting the instrument approximately in the plane of the wires by sighting the nearest wire, then removing it to see if the other wire is in line. However, it is a bad practice to use the short shaft base at all, nor should it be used except as a last resort, or where the shaft does not exceed 40 ft. and the extreme workings do not exceed 2,000 ft. distance from the shaft.

Band chains have given the greatest satisfaction in mine surveying. The one drawback to their use is that the feet number-plates are often carried away in passing the chain through the mines *debris*. This could be overcome by etching the numbers into the body of the chain as is done in the printed steel ribbons.

Safety Appliance for Derrick Cranes.—Many accidents arise from the breaking and inadvertent releasing of jib chains. A new arrangement, according to the *Engineering and Mining Journal* (New York), has lately been devised for preventing the falling of jibs from this cause. The extremity of the chain, by which the jib is raised and lowered, is made fast to the bolt at the jib head. This bolt is connected to a pair of pawls which take into two ratchet wheels, cast one on each side of the sheave over which the lifting chain runs into the jib head. The bolt is continuously urged forward to place the pawls into engagement by a powerful coiled spring, while it is drawn back by the tension on the jib crane. The sheave itself is cast with pockets into which the links of the lifting chain drop, and it runs in a casing which prevents the chain getting out of the pockets. If the jib chain breaks the jib begins to fall, and the pawls dart forward into the teeth on the sheave. The latter can now no longer rotate, and as the lifting chain cannot ride over it on account of the pockets, the weight of the jib is thrown on to the lifting chain, and its fall is arrested before it has dropped many inches. When a wire rope is used in place of the chain a modified arrangement is used which grips the rope.

Steel Cars for Mines.—A pressed steel coal car has been made by the Leeds Forge Company, Ltd., Leeds, England, under the Fox patents, for use in underground workings. These cars are designed more particularly for carrying coal and are adapted to be used either in the pits or for taking coal from the pit mouth to boats or cars for shipment. The underframe is made of pressed steel parts, ¼ of an inch thick and is not unlike the Fox freight car truck used in this country, except that the framing has end sills. The track is 7 feet long and 4 feet wide. The sides of the body are 3·16 of an inch thick and are corrugated to give rigidity and obviate the need of stays or stakes. The total weight, including wheels, axles and springs, ready for use, is 720 pounds. These cars have proved very satisfactory in English colliery work on account of their light weight and small cost for repairs.

Recent Gold Milling Practice in Nova Scotia.*

By John E. Hardman, S.B., Oldham, N.S.

In the practice of every art it is always desirable to have a body of reliable data accessible, to which to refer for comparisons, and by which to check one's own methods and results.

So far, in gold milling, the data on record refer almost entirely to large mills, *i.e.*, those having forty or more stamps; and to the (comparatively) softer ores of the United States and Australia. I have thought, therefore, that it might be acceptable to record some data for Nova Scotia, and for small mills of ten or twenty stamps. The time, perhaps, is opportune for the reason that within the last three years there has been a decided step forward in the business of gold milling in the province. Three years ago I had the honor to read a paper on the Empress mill at Renfrew,† which had then recently been built by Mr. D. S. Turnbull for the Empress Gold Mining Co., and which may be regarded as the pioneer mill of the new practice in Nova Scotia. This mill, in its design, construction, and detail, was a reproduction of the type adopted by the Homestake Mining Co. in their large mills at Lead City, South Dakota, and in its operation it fully sustained the reputation of the type for fast crushing, with close saving of the free gold. Like its prototype at the time, it had no concentrating plant to save the sulphurets, which were reported worth $20 or less to the ton. No figures of costs or results from this mill are available for publication.

Since the construction of the Empress mill in 1889, eight other mills, aggregating 150 head of stamps, have been built in the province in which the Homestake type of mortar (modified in three mills as to minor details), has been adopted.

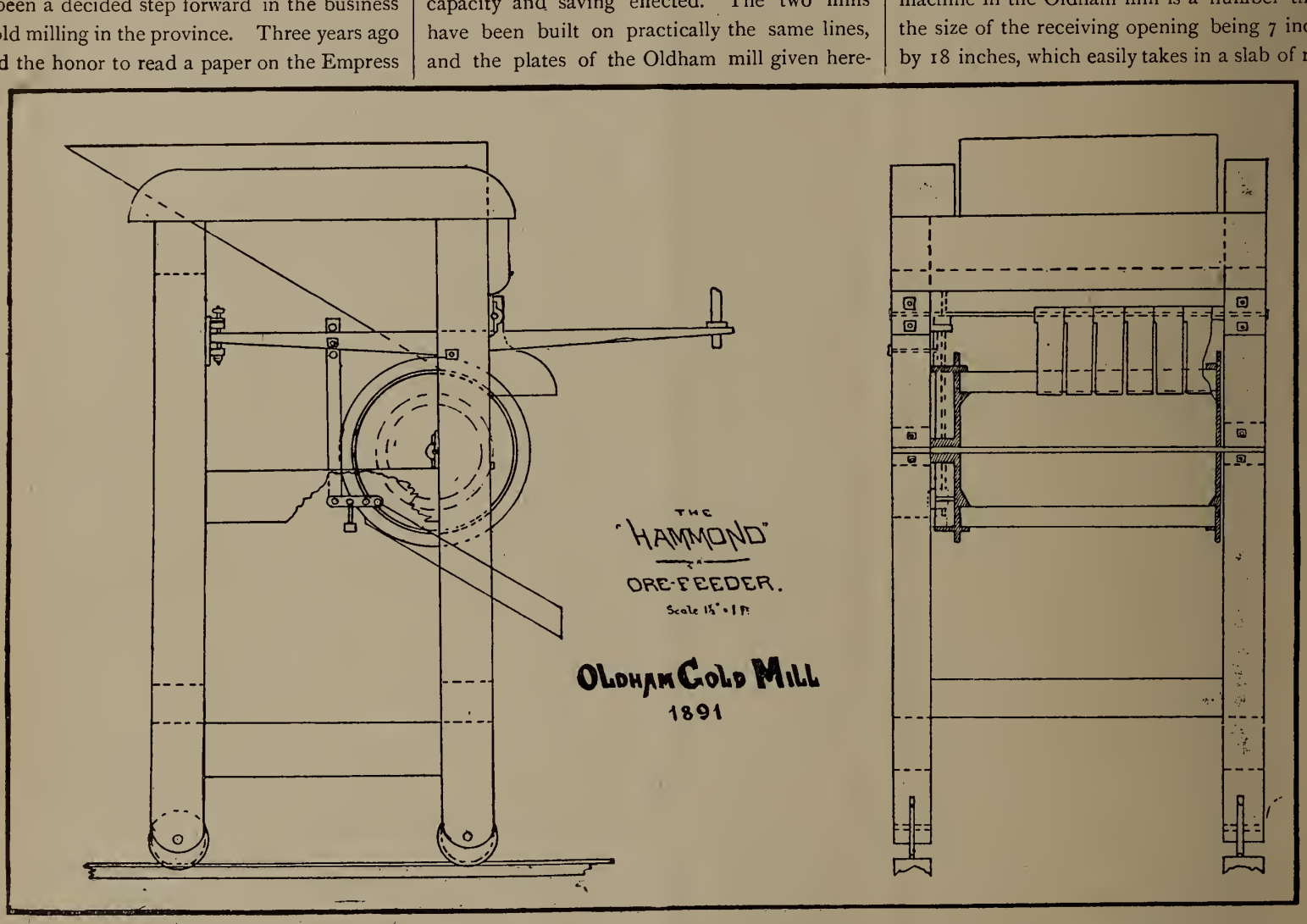
In these mills, the design and construction of the buildings, ore bins and accessories have been subject to local conditions, and hence have been of diverse character.

It is not my purpose to give descriptions of all these different mills, but rather to induce members in charge of the same to put on record their experiments and experience.

As to two of these mills, however, (those of the Oldham Gold Co., and the West Waverley Gold Co., Ltd.), which have been designed and constructed under my supervision, I am enabled to give you descriptions, and figures as to costs, capacity and saving effected. The two mills have been built on practically the same lines, and the plates of the Oldham mill given herewith show essentially the characteristic features of the Waverley mill. The Waverley mill is driven by steam power, the Oldham mill by water power. As the Waverley mill has been dropping its stamps for about two months only, the figures relating to it are given subject to correction, but the figures relating to the Oldham mill represent twelve months' continuous work. In designing the structure, care was given to make each component of the mill independent, *i.e.*, the building, the battery frames, and the ore bins are each entirely separated from the others, so that the building is simply a cover with no strains upon it other than those due to wind and weather; the battery frames are not connected either with the building or the ore bins, and hence no vibrations are communicated to them or from them to other parts of the structure; also the ore bins, upon the top of which is placed the rock breaker, are free and disconnected. The mill contains but ten stamps, and its character and design will be readily understood from the accompanying plan and sectional elevations. I may say here that no originality is claimed for either of these mills. In their design and construction the whole object was to select the best features from practice in other places, and such as had been proved and tested, and to combine them into such an aggregate as should be efficient, economical, and best adapted to the work required.

As to the machinery details, the first one to which I will draw your attention is the use of the "Forster" rock breaker, in the place of the old "Blake" and the newer "Gates." The machine in the Oldham mill is a number three, the size of the receiving opening being 7 inches by 18 inches, which easily takes in a slab of rock 6 inches by 17 inches. The Waverley mill has one of the largest size, jaw opening being 12 inches by 21 inches, and capacity being 125 tons in ten hours. The preference was given to the Forster in both of these mills for the following reasons: (1) for machines of equal capacity the Forster requires very much less power than either of the others, taking less than one-half the power required by a Gates; (2) the total weight of the Forster machine, of equal capacity, is only about one-half that of the Gates and considerably less than that of the Blake; (3) the vibratory motion induced by the machine is very much less than that produced by the Blake, and no more, if as much, as that produced by the Gates; (4) the cost of the Forster is less than either of the two others.

In small mills, to which I wish it clearly understood my remarks are meant to apply, the



* Transactions Mining Society of Nova Scotia.
† Canadian Mining Review, vol. viii., p. 73.

points referring to the amount of power required and the first cost of the machine, are important factors, and where the breaker is mounted on the top of the ore bins, total deadweight and the vibration are almost equally important. For larger mills I am inclined to consider that the Gates might be preferable, but I can see no situation where I believe a Blake would be the equal of the Forster.

The small breaker in the Oldham mill is driven 300 revolutions per minute by a 5 inch belt, and at that speed crushes 5 tons an hour to pass an inch and a half ring.

From the rock breaker the ore drops into the ore bins, which present no points of novelty and which will be easily understood from the sectional view. Chutes lead from these bins to the hopper of the "Hammond" automatic feeder. The feeder is the one which has been in use at the Alaska-Treadwell mill on Douglas Island for some years. It has given us every satisfaction. It is positive with wet and dry ores, is superior in its freedom from attendance, can be regulated with great exactness, and is much cheaper both in first cost and repairs, than either the "Tulloch" or the "Challenge." Its construction will be readily understood from the drawing. A small auxiliary split tappet fastened on one of the stems between the guides, serves to operate the lever.

The style of battery frame is new to Nova Scotia, being adopted from the Grass Valley practice, where it is known as the "knee frame." Its essential point is the removal of the line shaft from its usual position behind the mortar, and beneath the feeder floor, to the front of the batteries and on a level with the cam shaft.

The merits of the arrangement are many: (1) the shaft is always in sight, it has the best light in the mill, and is easy to align when necessary; (2) it is removed from beneath the feeder floor, where it is in darkness, and subject to the dampness, drip and fine dirt which will inevitably work down upon it and its bearings; (3) any repairs to the shaft when below the feeder floor have to be made by artificial light, and in confined spaces which are usually abounding in grit and fine dirt; (4) it enables the cam shaft belt to be run horizontally, or nearly so, without a tightener, and thereby saves a great deal of wear on the belt. As against these advantages, one possible point of disadvantage is made, viz: that the main shaft is more liable to get out of alignment when erected on this knee frame than when placed on the solid cross sills behind the mortar blocks. To this it may be answered that if the knee frame is properly made and braced, of heavy timbers, the chances of malalignment are very slight and are easily remedied.

On this line shaft a Hunter friction clutch pulley serves to disconnect the cam shaft without disturbing the running of the rest of the mill.

The mortar blocks are built of selected two inch spruce plank, twelve inches and six inches wide, planed on both sides and jointed on both edges. The blocks are built thirty inches wide, and are therefore made up of two twelve inch planks and one six inch in each layer; joints in one layer are broken in the next, and each layer is spiked to the previous one with 40dy. nails (five inches long), so that each nail holds in three layers. Each plank is fitted on the bottom to the surface of the solid bedrock, as it was found impracticable to dress off the whin rock to a smooth and level surface, and concrete is valueless unless put down in large masses.

The two blocks for ten stamps are built together, so that the Oldham foundation is one solid piece of timber thirty inches wide, fourteen feet deep, and twelve feet two inches long. In the Waverley mill the blocks were built in the same manner, but are for twenty stamps. As bedrock was four feet deeper, and a clear space of four feet was left between the two cam shafts, the final block in Waverley measured thirty inches by eighteen feet by twenty-eight feet four inches.

The holding down bolts were put in as usual, with the exception that the standard threads for one and one half inch bolts were not used; instead of six threads to the inch, twelve threads to the inch were used, with standard size hexagonal nuts. This substitution of a finer thread not only gives greater strength,* but also serves to prevent the jarring loose of the nut by the vibration of the mortar.

The mortars are modified from the Homestake pattern only in the fronts, which are cut down to within two inches of the bottom, the height of the front being regulated by wooden chuck blocks faced with thin steel plate. Also the lip has been extended three and a half inches. The accompanying detail drawings will show the character and extent of these changes.

The essential character of the mortar is not at all affected by these modifications which have been made only for minor points of convenience. The cutting down of the front was done for two reasons: first, because the Oldham mill is also a custom mill and it was desirable that the whole inside of the mortar should be readily accessible for a thorough clean up; and secondly, because of the very diverse character of the quartz coming to a custom mill, necessitating perhaps a high discharge for one lot and a very low discharge for another lot. It has been found also, in the experience of twelve months, that the slight spring, or give, which the wooden chuck block has (although *very* slight) is sufficient to cause the amalgam to settle a little lower round the dies than it does in the solid front type. The extension of the lip was made in order that the apron plates might be entirely free from the mortars, and receive no motion or vibration therefrom.

The cams, tappets, bosses, shoes and dies are of the usual Homestake pattern, the full stamp with new shoe, weighing 858 lbs. Sectional guides such as were described in the paper on the Empress mill, have been used, with the addition of a long diagonal washer to prevent checking or warping. The guides are 14 inches long, made of sound yellow birch wood. They have been in use in the Oldham mill for twelve months, and are good for several months yet before being trimmed down. The lubricant used is a mixture of tallow and graphite, applied warm. The front elevation of battery frame shows the sectional guides in position, but does not show the diagonal washer.

The plates for catching the amalgam are four in number.

The first plate lies inside the mortar, just at the lower edge of the screen, and about ten inches above the foot of the dies. It is made from a strip of copper one-eighth of an inch thick and one and three quarter inches wide; the length being the full length of the screen, about forty-eight inches. This copper strip is placed on a bar of square iron, and from one-quarter to three-eighths of an inch in width is bent over at right angles for the whole of its length. It is then fastened to the rounded or bevelled edge of the wooden chuck-block by screws, the longer side sloping upwards towards the screen at an angle of about 45 degrees with the horizon, while the shorter side inclines towards the stamps at an equal angle, forming a narrow V shaped trough, as shown in fig. 1 sectional view of the mortar.

This plate has proved most effectual, as will be shown further on, and the wear upon it, after twelve months, is not noticeable. It does not choke nor fill with sands, the splash from the screen being sufficient to dislodge the sands but not the amalgam. Outside the mortar there is a splash plate eight inches wide, set at a run of three-quarters of an inch to the foot, which catches 80 per cent. of all the gold caught outside of the mortar. This plate discharges the pulp upon what is called the "quadrant plate," which is a sheet of copper running the full width of the apron plate, but curved round the quarter circumference of a circle whose radius is 9 inches in the Oldham mill and 6 inches in the Waverley mill. The prime function of this plate is to spread the pulp perfectly smooth and even upon the long apron plate below, but it has also been found to be a most efficient amalgam and mercury saver. From this quadrant plate the pulp has a drop of one inch upon the upper end of the apron plates, which are fifty-four inches wide by ten feet long and have a pitch in the Oldham mill of one and three-quarter inches to the foot From the apron plate the pulp drops into a box on the end of the wooden table, whence it is led by an iron pipe two inches in diameter to a mercury box of the Grass Valley type, thence through a short wooden sluice to a box of the same pattern as is used in the Black Hills, thence, in the Oldham mill, to a Golden Gate concentrator, which handles all the sands from ten stamps with ease, being from 24 to 30 tons in 24 hours.

The tables upon which the apron plates are laid are arranged so that the pitch can be varied from one and three-eighth inches to the foot as a minimum to two inches to the foot as a maximum. Reference to the sectional elevation of

* See paper of Major W. R. King. Trans. A. I. M. E., vol. xiv., p. 90 *et seq.*

the mill will show that the tables (F) rest upon two stringers (A) of 3″ x 5″ scantling and are kept from sliding downwards by a block or cleat (G) nailed to the stringer. These stringers lie loose in notches or gains cut in the standards (B), and a hard wood pin (C) keeps each stringer from sliding downwards, but admits of sufficient freedom to raise the lower end as required. The standards are nailed to the floor and have no connection with the mortar blocks, nor has the floor, a coarse saw-cut separating the boards of the floor from the blocks. At the lower standard a hard-wood wedge (D) is inserted, which has a slot cut in the middle, through which a bolt (E) and thumb nut is run. By means of this wedge the inclination can be changed to suit the character of the pulp passing over the plate, the wedge being locked in position by the thumb nut. The upper edge of the copper apron plate is turned up one inch, behind the lip of the mortar, but not touching the mortar, so that there is no point of contact between the outside plates and the mortars.

The floor of the battery room is laid in hard pine with a pitch of half an inch to the foot, and a sluice is arranged to carry all washings from this floor to a mercury trap below. The floor is washed down by a hose every shift.

The lowest floor of the mill measures 38 feet by 30 feet. Upon it, besides the Golden Gate concentrator, are the boiler for heating the mill in winter, the coal bin, the retorting and smelting furnace, and the casing or housing of the Pelton wheel which furnishes the power for the mill. The shaft of this wheel is on a level with the floor, the wheel-pit and tail-race being excavated below it. From this shaft a sixteen inch, six ply rubber belt conveys the power to the line shaft, whence it is distributed to the cam shaft, the rock breaker, the exhaust fan and concentrator.

The Pelton wheel referred to is a six foot standard single nozzle wheel, operated by water under a head of seventy-six feet eight inches, or a pressure of about 33 lbs. per square inch. This water is brought in by a ditch 1,026 feet in length, to the forebay, whence 540 feet of pipe, made of No. 14 gauge iron and sixteen inches in diameter, conveys the water to the interior of the mill. Inside the building the diameter of the pipe is gradually reduced to eight inches, where it is joined to the wheel gate by flanges. This pipe line is provided with three valves, located in appropriate places, one for blowing out air when filling the pipe, one for automatically admitting air in the event of a vacuum being formed in the pipe, and the third valve is an Ashton pop safety to relieve any abnormal pressure arising from suddenly shutting the water off the wheel. Four nozzles of different diameters (2¾″, 3″, $3\frac{4}{10}$″ and 4″) are supplied, to be used as the demands of power vary ; the three inch nozzle is the one usually used at Oldham. With this size of nozzle, venting about 250 cubic feet of water per minute, the wheel develops more than 25 horse power, which is sufficient to run the entire milling plant.

I am informed by the Pelton Water Wheel Co. that this is the first wheel of the kind sent to Canada, outside of British Columbia. It has been continuously in use since it was installed, and has given every satisfaction, both in cold weather and in summer.

As Nova Scotia abounds in water powers, in which in many cases the flow of water per minute is too small to be utilized to advantage in a turbine, it may not be out of place to say that this wheel will render many of these powers valuable wherever the conditions are such as to permit of obtaining readily a head of 40 feet or more at reasonable distances.

The motive power of the Waverley mill is a tandem compound condensing engine, cylinders 8″ and 12″ by 12″, with a Meyer's adjustable cut-off. Boiler pressure is carried at 100 lbs., and steam is cut off at ¼ when condensing, and at ⅓ when run compound but not condensing. The economy of this type of engine is too well known to need further demonstration.

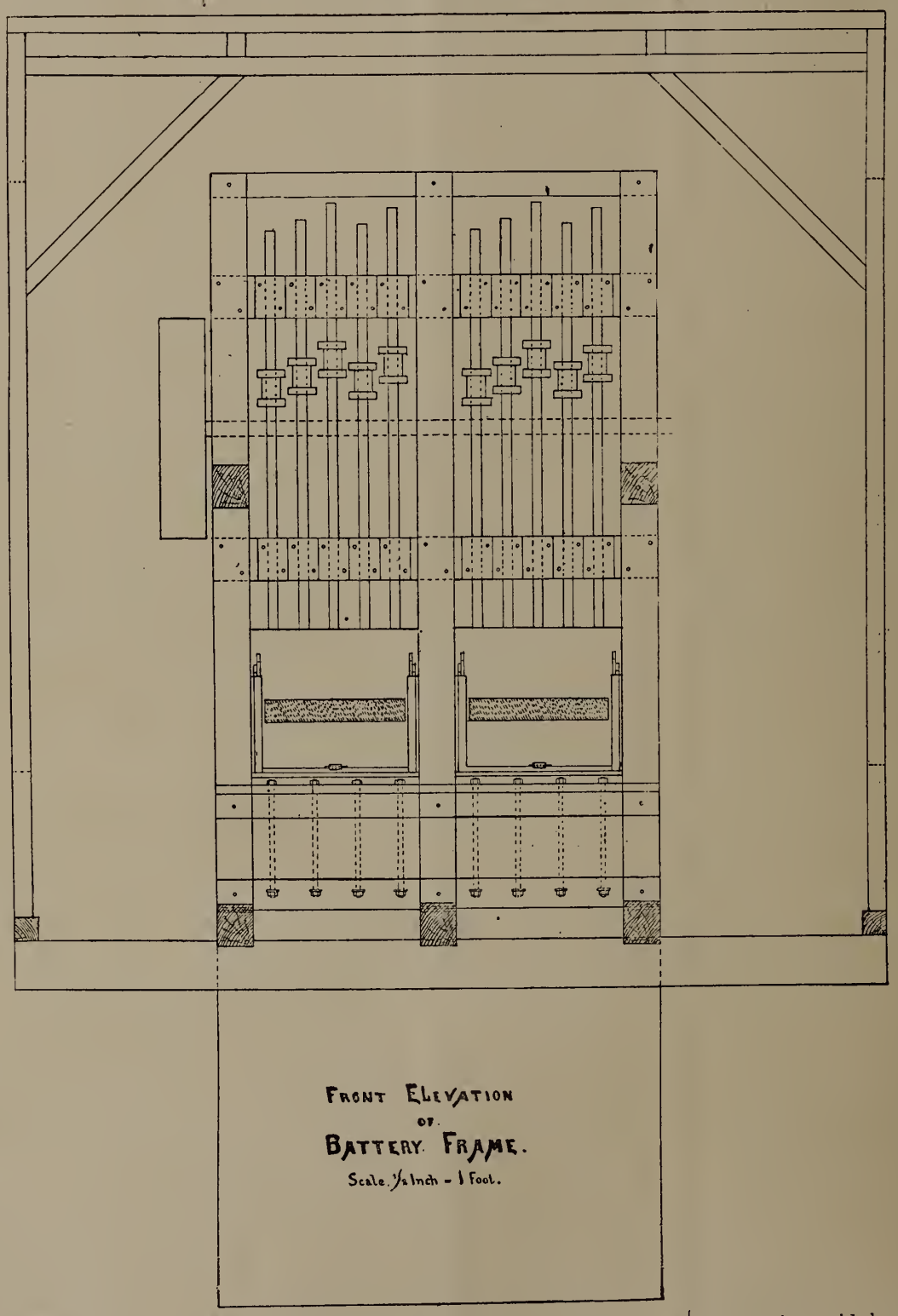
In the Oldham mill the pulp, after leaving the last mercury trap, flows into the hopper of a Golden Gate concentrator, whence the tails run into the brook, the headings being saved in a box. The average mineral contents of the quartz crushed is about 2 per cent., the sulphurets saved are very clean, averaging over 90 per cent. mineral, and assay $70 per ton in round numbers.

No concentrator has yet been added to the Waverley mill, the merits of several machines being under consideration. The percentage of sulphurets will run about the same, from 2 per cent. to 3 per cent.

This brief description of the equipment and character of the mills under consideration will serve to bring out the main points wherein the recent practice differs from the older practice. The adoption of the narrow mortar with inclined screen, the rapid, but short, drop of the stamps and the narrow V shaped inside plate, are features which have been developed by reason of the necessity for getting increased capacity without impairing the efficiency of the battery as an amalgam saver.

I am enabled to give some of the actual working results of these mills, and hope to supplement them in a future paper.

As to increased capacity: The Oldham mill drops its stamps 85 drops per minute, six and

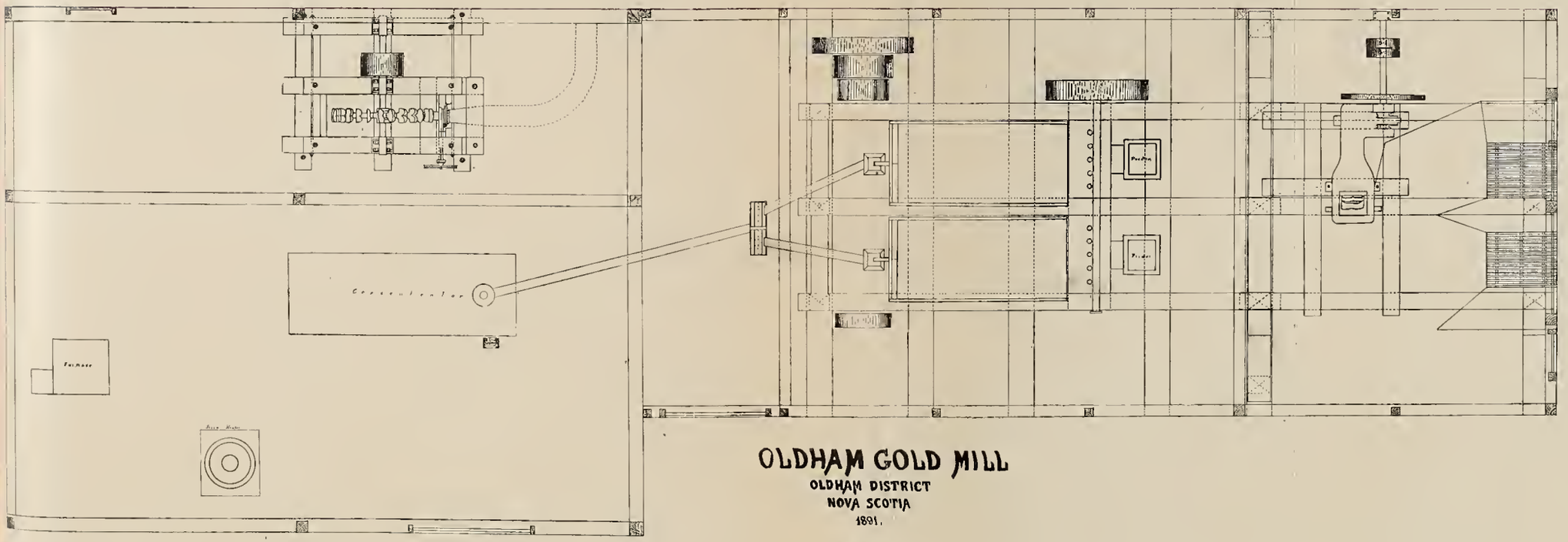


FRONT ELEVATION OF BATTERY FRAME.
Scale. ½ Inch = 1 Foot.

TRANSACTIONS OF THE MINING SOCIETY OF NOVA SCOTIA

To Illustrate Mr. John E. Hardman's Paper,

"RECENT GOLD MILLING PRACTICE IN NOVA SCOTIA."



OLDHAM GOLD MILL

OLDHAM DISTRICT

NOVA SCOTIA

1891.

PLAN

Scale ½ Inch = 1 Foot.

a-half inches, and the screen used is an indented Russia iron slot, having a No. 7 needle, the equivalent of 30 meshes to the inch. Under these conditions the capacity of the mill is from 28 to 30 tons per 24 hours, or 1 1/6 to 1 1/4 tons per hour: or 2 8/10 to 3 tons per stamp per diem.

I may say here that the Oldham mill has to be used as a custom mill, being the only operating mill in the district. Hence the variety in the character of the quartz in the lots presented for crushing causes a considerable variation in the capacity under the conditions given. From clean, hard, compact quartz, the mill often goes upon soft, much weathered and decomposed slate belts, carrying very little hard quartz. But with the speed, drop and screen given, the capacity of the ten stamps is a minimum of 1 ton per hour, and a maximum of 1 1/4 tons per hour.

As to the efficiency of the amalgamation, I have summarized the results of the last twelve months' work from records which have been kept of each and every lot or parcel crushed. As stated before, the lots come from three different companies as well as from tribute workers, and the gold contents varied during the year from $1.50 per ton to $800 per ton of stuff crushed, the average being about $18. The size of the lots also varied from 5 tons to over 200 tons.

Of each separate lot a record is kept, showing among other things:—

(1) The weight of material crushed.

(2) The time occupied in actual milling.

(3) The weight of amalgam obtained from the outside plates (*i.e.*, splash, quadrant and long apron plates).

(4) The weight of amalgam in inside V plate.

(5) The weight of amalgam in mortar sands.

(6) The weight of retorted gold.

There is, therefore, a body of data upon which to base satisfactorily a general average, and also an opinion as to the efficiency of the mortar.

Calculated into percentages the results are:—

	Per cent.
Percentage of gold on outside plates....	8.55
" " inside plates.....	23.40
" " in mortar sands	68.05
Total gold.....	100.00

It will be seen that the percentage of gold retained in the mortar behind the screen is 91.45 or 91½ in even numbers.

The *highest* percentage ever obtained on outside plates was 15 4/10, leaving 84 6/10 per cent. as the lowest percentage of gold saved in mortar.

The *lowest* percentage ever obtained on outside plates was 2 8/10, or 97 2/10 per cent. saved in mortar.

These figures are, to my mind, the most satisfactory answer to the statement which has been made, that this style of mortar would not save the gold inside the screen, but would grind it. In only one case have I seen the gold show signs of having been ground, and that was in one small lot which was crushed while the cam shaft belt was slipping, and the speed was consequently reduced to 70-75 drops per minute.

The mill-man seeing these figures will next ask: "What is the value of your tailings?" The average assay value of the tailings as they go upon the concentrator is $2 per ton, but this value is almost entirely in the sulphurets, the tailings from the concentrator varying from 20 cents to 50 cents per ton. Samples of tailings from which the sulphurets were eliminated by careful panning showed only traces of gold.

The mill-man from Australia or South Africa will be inclined to doubt these figures until he is told that the gold in Nova Scotia quartz is coarse (comparatively speaking). It is very doubtful if there is any quartz vein worked in Nova Scotia which carries gold of such a degree of fineness as to be invisible to the eye, or so fine as not to be saved by stamp-mill work if the mill is a proper one and the amalgamation skilfully performed. I am fully aware that this statement will provoke discussion, but I make it after nearly eight years diversified experience in this country, and after two years very careful study of the question. In some veins the sulphurets carry fine gold mechanically combined, of which a certain proportion is set free by fine grinding in a pan, but all such sulphurets with their contained gold are much more satisfactorily handled by concentration than by fine grinding with the consequent sliming.

The essential and important factor of this large percentage of gold saved in the mortar is the rapid short drop of the stamp. With the narrow mortar of western pattern, slow speed is the enemy of successful saving of gold behind the screen. The relative height of the screen above the die, and the coarseness of the mesh, are important factors it is true, but they are entirely secondary to the speed. I have dilated somewhat upon this point because some of the mills having mortars of this type in Nova Scotia have been blamed for not saving gold, and upon them has been laid the blame of unsuccessful ventures.

Whatever the true cause of these failures may be, it certainly cannot be the form of the mill mortar, if this same form does the good work it has done for years in the Western United States, and has done lately in the mills under consideration in this paper.

The results, as to capacity and efficiency, in the Waverley mill, although covering only a limited period (some 800 tons crushed) fully bear out the figures given above. The speed in the Waverley mill is 100, the height of drop six inches and the screen 30 mesh. The duty is 30 tons per diem. The average saving behind the screen has been 90 6/10 per cent., on the plates 9 4/10.

Coming finally to the costs of milling, we naturally cannot expect small mills to work as cheaply per ton of material handled as the large ones do, but yet in Nova Scotia, where both fuel and labor are cheaper than in the west, we may expect to approximate the costs of the best mills elsewhere.

In Prof. Hofman's paper on "Gold Milling in the Black Hills," the cost at two different establishments is given as: $0.8349 per ton, and $0.87 per ton. If we deduct from these figures the item for fuel, a very expensive item there, the costs stand about .56c. per ton milled. Taking the costs at some of the best of the California mills,* the results in 1888 were:—

Plymouth mill, 160 stamps, water power.	$0.3900
Bunker Hill mill, 40 stamps, water power.	0.6000
Plumas Eureka mill, 60 stamps, water power.	0.4875
Sierra Buttes mill, 80 stamps, water power.	0.3450

The costs at the Oldham mill are given in detail as follows:—

	Per ton.
Labor	$0.2730
Supplies	0.0293
Iron	0.0264
Quicksilver	0.0205
	$0.3492

This figure, it must be borne in mind, is for a mill doing custom work, which necessitates much loss of time and consequent loss of tonnage, and higher costs per ton. The same mill, when running on large lots, has reduced the cost per ton for labor $0.063, making the total cost per ton for large lots $0.2862. During the winter months an extra charge of $0.0351 is made to cover the cost of fuel required to warm the mill. The highest cost per ton, therefore, in the Oldham mill during the past year has been 38 4/10 cents, and the lowest 28 6/10 cents.

Figures of costs for the steam mill at Waverley are not yet available, for the reason of the short time the mill has been at work, but the cost sheets for May showed the figure of 48 4/10 cents. I have reason to believe that this figure is not far astray; and that the result of the first year's work will show a cost figure not to exceed 50 cents per ton.

*California State Mining Bureau. Eighth Annual Report of State Mineralogist.

The Use of Asbestos in Mines.

Asbestos is a highly refractory fibrous mineral, having about 90% of silica and magnesia in its composition. It is insoluble in water, and will not change its mechanical (that is, fibrous) structure when wet.

The application of asbestos in operating mines, is to insulate steam connections. The problem which confronts the mining engineer is, how to secure good results with a steam boiler at the mouth of the pit, and a pump several hundred feet under ground, or a fan several hundred yards away from the boiler, necessitating the use of long lines of steam pipe which must be covered with a non-conducting material to prevent the radiation of heat.

This pipe often runs close to the tracks in slopes and along haulage roads, or is hung perpendicularly in shafts, where it meets with the roughest usage and is often subject to the constant drip of water, sometimes strongly impregnated with sulphur.

Of what form and of what materials to make an insulator that will be of service under such trying conditions is the question that must be solved. That the pipe must be covered is scarcely a matter of debate. Assuming the pipe to be 4" internal diameter, and the run, say 1,000 feet, the exposed iron surface will be 1,250 square feet, *i.e.*, the equivalent of a flat surface 125 feet long by 10 feet broad.

Assuming, further, a steam pressure of 70 lbs. we have a body of heat at 316° Fahr., 1,250 square feet in extent constantly radiating into an atmosphere about 250 degrees cooler than itself, with results which anyone familiar with the condensation of vapors can easily predict. Theoretically, it would take over 8 tons of coal per annum to remedy the waste in each 100 lineal feet of pipe, or, at $3 per ton, $24 per 100 feet, making a total waste on the line of pipe in question of $240 per annum, but practically the pump could not be run, as the water of condensation would clog the cylinder and valves so as to stop the motion and injure the machinery.

With the pipes properly insulated by the application of a good non-conducting covering, all this loss can be prevented, and perfectly dry steam delivered at great distances from the boiler.

The loss from radiation under such favorable circumstances is infinitesimal, and compared with the loss of waste through friction and other causes, is not worthy of note. It is hard to obtain reliable statistics owing to the difficulty of making accurate observations from apparatus covering so much ground. In a recent test, however, of a system of piping carrying hot water under pressure at 400 degrees Fahr., the total loss, in a travel of 10,000

feet, chargeable to radiation, was placed at 3%. These tests were made by competent engineers, and with the use of every means known to science. All of the pipes in question were insulated with 1½" in thickness of asbestos.

Having considered the possibilities of the case, we now revert to the main question. What material, if any, will answer the purpose?

Such material to fully answer the purpose must fill the following requirements:—

1. It must be a non-conductor of heat.
2. It must be unaffected by heat.
3. It must be unaffected by water.
4. It must stand rough usage.

A countless list of articles have been offered by enterprising vendors, with various devices for fire-proofing, water-proofing, etc., and in turn have been discarded for some fatal defect.

The fire-proofing lining has been found no protection or the water-proof cover has been broken away and the water has destroyed the coverings.

It may be interesting to review a few of these to see in what way they fall short of the standard we have just set up, *i.e.*, durability under heat, water, and rough usage.

First comes hair felt, the oldest form of pipe covering in use, one of the best non-conductors of heat known, because so full of air cells, but hair felt is short lived under heat, and disintegrates rapidly when wet. The various fire-proof linings used under hair felt do indeed prolong its life but do not give it real durability, and for mine work it cannot be recommended. Then there is an extended list of paper pulp and wool felt materials, usually made up in sectional or cylindrical form. Some have a thin sheet of asbestos as a lining, placed there more for appearance than use, as a close examination will show the asbestos to be too thin to afford much protection.

The best type of this covering is made of alternate layers of wool felt and asbestos sheathing, laid up in cylindrical form so as to leave air spaces. But this covering while efficient and durable, under ordinary circumstances, will not stand the exposure of a mine shaft; the wool felt will char, leaving the asbestos.

We would refer right here to the well known effect of heat and moisture on organic substances, which is to disintegrate them rapidly. Hence these, and similar covering, containing a large percentage of hair, wool and other organic matter will be quickly destroyed in mines, and we therefore lay down the general proposition that no covering should be adopted for use in mines that contains organic matter in its composition.

The various forms of non-conducting cements are more durable under the heat but are too easily injured by rough usage to last long in a mine. We can divide them into two classes, those containing heavy clays or earths with animal or vegetable fibres as binders, and those made from asbestos and infusorial, or fossil earths. The former are only nominal pipe coverings, as they do not retain the heat and have no real value. The latter have merit, but are not of service in the line of work we are now contemplating.

In connection with these cements or plastic coverings, we find in use several made from mixing magnesia or plaster with asbestos. The asbestos acts as a binder and adds to the strength of the plastic compound, which is formed into sections or slabs, but the objection urged against the use of cement in mines holds good against this form of material; it will not be found durable.

We have just referred to various forms of non-conducting coverings and point to the fact that in each case the materials used in their make-up other than asbestos cannot be recommended for use when exposed to great heat, continued moisture, and rough usage.

We now point to another most important fact to be observed, which is that all the durability these goods possess is found in asbestos fibres, which they contain. The hair, wool, paper, pulp, etc., chars under heat, while the clay, magnesia, plaster, and other similar fillings wash away under exposure to moisture or crack and break when subjected to abrasion.

It was the discovery of these facts that led to the construction of the style of pipe covering manufactured by the H. W. Johns Manufacturing Company. This meets all the demands of mine work, and we will now fully describe it.

It is an established fact that the non-conducting property of a material depends not so much on the elements of which it is composed as on their mechanical arrangement. A material which is made up in solid and compact form, so that its particles be in close contact will be a poor non-conductor of heat. If, however, this same material be loosely felted together so as to form numerous air cells between its particles or fibres it will then prove an excellent non-conductor of heat, and it is such substances only which admit of such treatment that are useful as non-conductors of heat. Asbestos, for instance, is popularly known as a mill board or sheathing, and in this form is only a fair heat insulator, while in the loose or fibrous form it is one of the best non-conductors of heat known.

In conformity to these well proven facts the covering we are about to describe is made solely from fibrous asbestos.

The asbestos is taken in its crude or natural state, and by special processes it is cleaned from all foreign substances and the long silken fibres are selected and separated and divided until they are as loose and fine as a bat of cotton.

This material has been found to answer the first stipulation as laid down earlier in this article, *i.e.*, it is a good non-conductor of heat.

It also meets the second requirement and will stand the most intense radiated heat that can be brought to bear on it, for it is entirely free from all organic substances, and hence will meet the third requirement, which is to be unaffected by water.

This material is then taken and by machines invented by the H. W. Johns Company, it is shaped into cylindrical form, of sizes to fit pipes of any diameter and of any required thickness.

These cylinders or sections of asbestos are then cut on one side so as to open and slip over the pipe, after which they are neatly jacketted with suitable material and provided with bands and buckles to hold them in place.

For mine work, under favorable conditions, the jacket is a light cotton duck which is afterwards coated with a water-proof paint to keep the covering dry as possible. But in very wet places, and under trying conditions, a jacket of asbestos and wire cloth is substituted. This is a special material formed by uniting layers of asbestos through the meshes of wire cloth after which the material is water-proofed. This forms a jacket of great strength and durability, unaffected by heat and impervious to moisture.

These jacketings are to give finish to the coverings, and also to prevent any excess of moisture in them, as moisture fills the air cells and promotes conduction of heat. The covering does not depend on the jacket either for its strength, or for its protection, as the asbestos fibres from which it is made have in themselves great strength and will stand very rough handling. If they are wet they dry out again without in any way injuring the covering.

We have thus far treated asbestos only in its function as a non-conducting covering, and we can justly claim to have demonstrated its unequalled merit for this purpose.

There is certainly no material known that in any way approaches to it for such a purpose.

But it is not only in this way that it is useful to the miner. There are many other ways in which it is useful and doubtless many more will be devised in the near future.

It is largely used as a piston packing in cylinders of engines and pumps, and also as a flat packing to make cylinder heads, steam chests, and all kinds of flange joints.

As a fire-proofing it admits of great possibilities. Its long silken fibres can be spun and woven into a fine fabric that would make an excellent brattice-cloth, and the many light flexible and durable forms into which it can be made could, when intelligently used, greatly decrease the fire risk in mines.

We venture to predict that the present known uses of asbestos are to its soon to be discovered possibilities, as the feeble steam of the pioneer Cornish pumps are to the present million gallon Worthingtons of to-day.

We therefore commend it to the notice of every thoughtful and progressive mining engineer.

Notes on Sampling.

By Herbert R. Wood, M.A.*

Vein and Mine Sampling.—On the methods of sampling, vein outcrops, prospects and mines, depend the actual value of the property, and its value as known to the public. Vein contents, their assay value at the surface, and at moderate or great depth, vary greatly. The character of the ore-vein will largely determine the value of the assay-return method of sampling. The changed chemical condition which sulphides of iron, copper and lead, undergo at the surface, and frequently to considerable depth, with an increase or decrease of silver, renders sampling uncertain and not indicative of the actual value of the mine, but only in that region of the vein in which the sampling is done.

Vein outcrops rarely assay the average value of the vein; in some instances, however, they do, and, indeed, exceed the average value of the vein at greater depth.

A Prospect, or the first sampling done on a vein, should be made from a series of pits, dug at intervals along the vein, as a single excavation cannot represent the average value of the ore. Such pits should be ten or twelve feet in depth, and, if the vein is much decomposed on the surface, such samples cannot be taken as any criterion of the value of the vein throughout. Surface samples cannot be regarded of any value as to the real character of the vein. It has been said that the depth of the test pits should be at least ten feet, but they may be regulated according to the nature of the ore. If the surface cappings consist of iron oxides and the carbonates of low assay-yield, a short distance may reach the ore body in the form of sulphides, but this must be determined by the judgment of the prospector. Gold bearing veins are frequently richer at the surface, and the gold more apt to be in the form of large agglutinations, though at the immediate outcrop the gold may be entirely removed. When the gold accompanies iron pyrites, and oxidation goes on, the ferrous sulphate formed, acting as a slight solvent of gold, removes it, or washes it out, or deposits it in nugget-like masses.

In sampling ore in which there is native silver and silver sulphides, the same care is taken to get a quantity of ore representative of the quality of the vein, holding rock and silver in constant ratio.

In sampling a mine throughout, for buying or selling purposes, it should be sampled in all the levels, and the shaft as well.

1. When the ledge is exposed in end of tunnel, sampled thus, ×.

2. When the ledge is exposed in bottom of the shaft, sampled thus, ×.

3. When the tunnel follows ledge, the vein should be sampled from wall to wall, across both roof and floor, every ten or twenty feet.

In the shaft, the vein should be sampled from wall to wall on both sides, every fifty feet.

These samples should be kept separate, and separately assayed, and the average of all taken; or, the samples may be combined, quartered, crushed, and assayed—the result being the value of the ore output from the whole mine.

Pay streaks, when distinctly marked from the rest of the vein, may be separately sampled—such streaks usually constituting first-class ore, and the balance, second-class. When the ledge is decomposed on the surface, careful sampling should be made from wall to wall as usual. Marked variations in ledge matter should be kept separate.

Dump Sampling.—In sampling a dump, or an ore pile, it may be done quickly by grab-sampling. The sampler may be blindfolded while he picks up from the pile the fragments of vein and ore with which his hand comes in contact. Or, the pile may be sampled by a careful selection from its surface.

Car samples may be taken in the same way. None of these methods are as accurate as the regular methods of sampling for buying and selling purposes.

The most satisfactory method of sampling a mine is to take from five to ten tons of the ore and ship it to a mill or smelter, where the actual commercial value of the ore can be obtained. Such a car load should be taken from all portions of the vein.

Smelter Sampling—Slags.—In sampling slags it is better to do so while they are hot and fluid. A slender iron rod may be used, a portion of which bent at one end serves as a handle. It is thrust into the red hot slag and quickly withdrawn, and instantly placed in a bucket of water. The thin shale of slag coating the end of the rod falls into the water. Where the slag is run in pigs on the ground as from matte reverbatory furnaces, the slag must be broken before too cool, and the red hot thrust into its centre. In this case the rod is far the best, but when the slag is run into pots a small iron cap with a long handle may be used, the surface of the slag in the pot being broken and the cup thrust into the molten fluid, care being taken that all the particles of matte suspended in the slag be first allowed to settle. The slag in the cup should be cooled slowly, and, on breaking, present a glassy appearance. Slag may be sampled when cool, several pieces being broken off from it, but this method is more inconvenient, and is not so representative of the quality of the slag. Surface samples should not be taken as bits of coke or flux are apt to adhere.

Matte.—In sampling matte the cup should be used, the slight crust which has formed on the pot broken and the cup thrust well in, as slag is frequently on the surface. If, however, the pot is full of matte, it is not advisable to thrust the cup to the bottom as speiss is very apt to be present. The sample is cooled by dropping it into a bucket of water. Where the matte is run into a mould as in copper reverberatories the matte is sampled by breaking small chips from the centre and one end of the pig.

Zinc Pots.—The following is the method of sampling the zinc pots in the desilverization process: After the final zincing and the last alloy of zinc, a rich silver-lead is skimmed from the surface of the pot; and a long-handled pair of tongs having a cavity in each tong, which when closed resembles a bullet mould, is thrust into the pot by the workman, worked back and forward until heated, then suddenly closed, drawn up and opened on a clean board or flag-stone. This is the method of sampling the bottom of the pot, two bullets usually being taken. The upper portion of the pot is sampled by quickly thrusting in and quickly withdrawing a thin short bar of steel, rounded at one end; a thin coating of lead will adhere, which can be readily removed by slitting one side. These samples will vary slightly .10, .08. The lower portion of the pot usually runs a trifle higher than the surface sample, though the workman can usually tell by the nature of the last alloy removed, its crystalline structure, etc., whether the silver is all taken out.

Bullion.—The bullion direct from the blast furnaces is sampled with a punch hammer, which removes a core from each bar. These cores may be duplicated by one from the middle of the bar and one from the end.

When pure refined or test lead is manufactured, the desilverizing process is continued till the lead assays .005 or less silver to the assay ton. This requires a repetition of the zincing process, and a re-sampling after each removal of the zinc alloys. The sampling is performed in the same way, however, but the assayer uses two assay tons from the top and bottom of the pot, which he first scorifies and then cupels.

These should be taken, melted down in a pot by a moderate heat in a wind furnace and the contents poured into a mould. This may be done at the close of a month's run. The bar has a piece chiselled from the end and across the middle. This is rolled out with a hand roller to a ribbon the thickness of sheet lead, and with shears, cut across into the strips, then again cut across into small squares which are mixed up. Two assay tons weighed out which are scorified and cupelled. Usually it will be found that the middle of the bar runs a trifle higher in silver than the end.

Blast-Furnaces.—The furnaces are sampled at the lead wells, the antimonial and copper oxides brushed off the surface and a little lead poured on to a flat cold sheet of iron near.

Softening Furnaces. — The softening furnace is sampled in much the same way, the surface cleaned and sample poured on the flagstone pavement near the furnace.

Cupels and Silver Furnaces.—In sampling cupels the surface oxide is brushed away and a cup thrust in and the contents poured on a clean portion of the hearth.

* *School of Mines Quarterly.*

In silver furnaces the bar or poker end, first cleaned, is quickly thrust into the molten silver, coated and knocked off on to the hearth. The sample should be taken from a portion of the bath on which no trace of lead oxide floats. In sampling the silver while pouring into the moulds a bucket of clean water should be at hand, into which a portion of liquid silver from the ladle is dropped at intervals. If the ladle is held high and carefully shaken the silver will be granulated. After each sample the bucket should be cleaned and refilled.

In smelter sampling—such products as the *zinc oxide* formed by driving steam into the molten lead—after the zincing process, the *flue dust* from blast, cupel and silver furnaces, the *litharge*, *cupel bottoms*, *furnace linings*, the most of these being sampled and assayed at the close of a month's run.

The *sampling of flue dust and zinc oxide* is done by selecting portions from the heaps and cutting these down by a riffle to a small bulk.

The Dangers of Dynamite

In an article contributed to the *Genie Civil* of the 11th June, M. P. F. Charon, Ingénieur des Arts et Manufactures, discourses on the influence of dynamite on the health of miners, observing that its use—and in fact, the use of all so-called nitro-explosives in mines and public works—exercises an injurious influence, which it is desirable to point out. Dynamite is obtained by mixing nitro-glycerine with an absorbent substance, the office of which is to furnish a solid or, at any rate, a pasty mixture more convenient than a liquid one for use in mines. Notwithstanding the great variety of names given to modern explosives, for the most part they differ very little from dynamite, being mixtures of nitro-glycerine with one or more absorbents. Although some of them have as bases nitro-cellulose, nitro-benzine, nitro-naphthaline, &c., they are all nitrogen explosives, exercising an injurious influence through the poisonous or, at any rate, deleterious gases which they generate.

Theoretically, nitro-glycerine becomes decomposed into oxygen, nitrogen, steam and carbonic acid; but in point of fact, explosives of this nature, which are very difficult and dangerous to manufacture, give out a large volume of gas of highly complex nature, including carbonic oxide and vapours of nitro-glycerine, which, with the carbonic acid, are very dangerous to inhale, some of them, indeed, causing suffocation or poisoning. In addition to this, the explosion of dynamite often projects a *tourbillon*, or whirlwind, of dust, which penetrates the lungs, the injurious effects being in direct proportion to the quantiity of the charge. According to M. Berthelot, M. Vieille, and M. Sarrau, 1 kilog. (2·2 lb.) of nitro-glycerine gives out, on explosion, a volume of 713 litres (2,520 cubic feet) of gas and steam, when reduced to a temperature of zero Cent. 32 degs. Fahr.), and a pressure of 76 mm. (3 in.) of mercury, the elevation of temperature due to the explosion being 6,980 degs. Cent. Admitting a free and instantaneous expansion of these gases would be, according to Mariotte's formula, nearly 20 cubic metres (706 cubic feet). In a mine heading of 3 square metres (106 square feet) sectional area it may be admitted that the products of explosion, driven along by the enormous pressure developed, would displace double the volume of air,—that is to say 40 c.m., which is equivalent to 13 m. (42½ft.) longitudinally. Of course the gases very soon contract on cooling, and are dispersed more or less quickly by the ventilation; but it is no less true that these gases remain mingled with the atmosphere of the mine sufficiently long to incommode the men. Approximately these gases are composed of—steam 19 per cent., carbonic oxide and carbonic acid 58 per. cent., nitrous products 15 per cent., and nitro-glycerine vapour in varying quantity; therefore about 11,000 litres (388½ cubic feet) of carbonic oxide and carbonic acid, and 3,000 litres (106 cubic feet) of nitrous products are instantaneously liberated on the explosion taking place, and must exercise an injurious influence on respiration if the explosions are often repeated.

Dr. Darlington who studied the deterioration of the workmen's health owing to dynamite explosions while driving the tunnel for the new Croton Aqueduct, at New York, noticed the following symptoms:—Headache, cough, indigestion and nervous trouble, severe cases being characterised by nausea, vomiting, violent and irregular beating of the heart, and sometimes feeble and intermittent pulse, with all the effects of asphyxia and poisoning; and these symptoms led him to suppose that the smoke produced by dynamite explosions contains a certain quantity of volatilised nitro-glycerine in addition to the poisonous or deleterious gases already mentioned.

To counteract these injurious effects it is recommended to take a strong decoction of pure coffee, and to inhale the vapour of ammonia, sulphurous acid or a concentrated acetic acid; while a small quantity of carbonate of ammonia, a few drops of ammonia in coffee, a glass of water, or antipyrine may be taken. Prevention, however, is better than cure; and M. Charon recommends, as preventative measures, energetic ventilation at the working face to promptly carry off the products of combustion; while to prevent any partial vaporisation of nitro-glycerine, and even to considerably reduce the formation of nitrous vapours, a much more powerful detonator is recommended than that generally employed—for instance, 1 or 1½ gramme instead of only a ½ gramme of fulminate—a sufficiently powerful detonator having the advantage of causing more complete decomposition, thus approximately realising the theoretical formula of transformation into the simple gases of the explosive.

Mining Development in the Slocan and West Kootenay, B.C., Mining Camps.

By Walter B. M. Davidson, F.G.S., A.R.S.M., Etc., Ottawa, Ont.

In 1888 Dr. G. M. Dawson, C.M.G., published an excellent monograph on the "Mineral Wealth of British Columbia," and his general notes end as follows:—"In the southern district, for which information is most complete, praiseworthy efforts are now in progress at a number of widely separated localities, toward the exploitation of ores, which, in many cases, have already been proved to be of an exceptionally valuable character. Here, at least, we have every reason to believe that we are on the point of witnessing the inauguration of an era of mining activity of the most important kind."

This prediction has not been fulfilled before this year, and there is no doubt that the "era of mining activity" has only just begun.

There is probably no other country where there is such a magnificent opening for successful mining, which has been so much talked about, and where all legitimate mining—except coal mining—has produced so little in actual results. Without doubt all this will soon be altered, and British Columbia will take rank as one of the largest producers of gold, silver, lead, and copper, in the world.

It is easy to trace the reasons for the failures which have marked the history of mining in this Province. Since the dying away of the excitement which started in 1858, when over thirty thousand miners swarmed over the country—penetrating to the head waters of the wildest rivers, and leaving good pay washings for the possibly richer beyond—some gold has been washed by white men and Chinamen, though in constantly decreasing amounts; but this gold, up till now, with the exception of a few small sample shipments of silver ores, has been the only practical outcome of mining achievement. Next year I trust we shall be able to say, *Nous avons change tout cela.*

Not less than three smelters have been erected during the past five years, and another (of which more anon) is in course of erection; one built at Vancouver is now demolished; the one at Revelstoke has had only a disastrous trial run of a week or ten days; and that at Golden, although finished, has not yet been blown in. These three are on the Canadian Pacific Railway, and have all been built by town site companies, and not by practical smelting men. They all attribute their failure to smelt anything to the impossibility of purchasing ore, and to the high percentage of zinc and antimony in the small quantities of ore offered. It was presumed, without doubt, that the erection of these smelters would encourage the miners to mine and produce ore, but it has failed to do so; and I regret to have to record as the result of my observations during an extended trip through all the most important mining districts of British Columbia, that the production of ore is the last thing that these so-called "miners" aim at. Their only wish is to try and develop their mine until a "fine showing" is apparent, and then it is carefully left, and never disturbed, in the hopes that it may be sold to some sanguine capitalist. This system has been carried out even in the Silver King mine on Toad Mountain and the Lanark mine at Illicilliwaet, and in the claims of the prospector who never pretends to do more than prospect. There is no pretense of legitimate mining, and while many mines are in the hands of wealthy individuals, none of them have any idea beyond bonding their properties in the hope of selling out. The only notable exception to this is the Blue Bell mine on Kootenay Lake, owned by Messrs. Franklin Farrell and Tomlinson (of the Parrot mine, Montana), and A. B. Hendryx (of New Haven, Conn.), where the intention is to work the property.

Naturally, under this system, development has been painfully slow; work has been entrusted to cheap, and, therefore, usually incompetent men; there has been no systematic plan of mining, no mining machinery, and often, where there has been a "good showing," the owners will not touch it for fear that the next blast may injure its appearance. I cannot do better than quote Dr. G. M. Dawson's words, which are as true to-day as when written:—

"While speaking of causes which have hitherto stood in the way of vein-mining, it must also be mentioned that not the least important of these has been, and still is, the fictitious or exaggerated value too frequently placed upon entirely undeveloped discoveries. While it is manifestly right that the discoverer should be properly remunerated, it should be remembered that a mere surface showing, however promising, generally requires the expenditure of a large sum before its true value can even be ascertained, and that till thus developed it is unreasonable to expect a large payment for mining claims."

Under these circumstances it is scarcely to be wondered at that there are virtually no results, for foreign capital is shy of investing in any place where there is no output; and as a good tree is known by its fruits, so is a mining camp known by its results. One mine producing ore in paying quantities will attract more capital into the country than thousands of prospects, or specimens, or newspaper puffs; for what attracts capital is a successful mine, and the best advertisement is the figure of output in the mineral statistics. I trust that before next year there will be several mines which will have substantial returns to make.

The district which this year has received the most attention is the West Kootenay, particularly the Slocan district. I have just returned from a professional trip, when I visited all the important prospects. At the time of my visit there were six or seven hundred prospectors—mostly from the United States—camped in "the Slocan," and though most of them have located a claim or two, few discoveries of any importance have been made this year, and attention was centred almost entirely on the most important of the discoveries of last fall. These were, "The Noble Five" group of five claims, (including the Noble Five and the Bonanza King), the Slocan Star, the Freddy Lee, the Lucky Jim (the last two were located by "float" last fall, and found in place this year). There are others, such as the Payne, Chambers, and other groups, which, while being promising prospects, present no extraordinary features.

The different mineral deposits are found in a black argillite or phyllite of the Nisconlith Series (Dawson) of the Cambrian age, which lies unconformably upon micaceous and hornblendic schists, quartzites and gneisses of Cambrian age. The mining field is a basin some twenty miles long by ten miles wide, and it is underlaid by micro and macro-crystalline granites to the south, and by an altered volcanic rock (mostly trachyte and diabase) to the north. The argillites are much contorted and folded, the cleavage planes are indistinguishable from the bedding planes, and they are traversed by frequent dykes of intrusive granite or felspathic trap. The argillites are frequently fissile, and are often calcareous.

The different mineral claims have generally a similar formation, and vary only in width, assay, and continuity. They have probably been formed in the following manner: When the upheaval which caused the mountain range took place, these slaty beds were crushed and folded as a quire of paper might be crushed between the hands; in this way certain crevices and spaces would be formed lying parallel with the bedding planes, or at right angles to the direction of the pressure. This pressure was energy and was accompanied by heat, and the two caused a molecular redistribution of the minerals contained in the calcareous clay slate, and the crevices were filled up by different minerals, quartz, calcite and argentiferous galena predominating. I noticed as associated minerals marcasite, copper pyrite, zinc blende, bornite, and tetrahedrite (Fahlerz), but only in small quantities. The galena is locally distinguished as "coarse cube," "steel" and "wavy" galena, the latter usually being antimonial. The pyrite is sometimes arsenical, forming mispickel. Crystallization is rarely complete and there are very few vuggy cavities.

The mineralized zones seem to be fairly regular and continuous for some little distance. At the Bonanza King, the zone is plainly traced on the course of a snow slide for two or three hundred feet, varying in width from six to fourteen feet, carrying a very varied percentage of galena in places; the galena appeared to form about ten per cent. of the zone, and there were occasional lenses of a foot to eighteen inches in width of pure ore. As no work had been done except clearing away the snow, and in places a little picking on the surface, it is impossible to estimate the percentage of lead ore to the total contents of the mineralized zone.

The assays of the galena vary extremely, but without doubt they carry an exceptionally high percentage of silver, varying from 80 oz. to many hundred ounces per ton. This group of mines, in my opinion, will prove to be a very fine property, judging by the surface indications, and of the claims, I think best of the Bonanza King. From its altitude, over 6,000 feet, and the great steepness, of the mountain, the want of water, and the ever present danger of a snow slide, the development work will have to be very carefully laid out, and in working the mines successfully there are many difficulties to be overcome. Judging from the surface indications it will be possible to cob and hand pick a good deal of the ore, but when operations are undertaken on a large scale the proper way to treat the ores will be to send the majority of it through a crusher and some form of separators; to do this it will have to be sent down 2,000 or more feet to Carpenter Creek, which can be best done by ærial tramway.

For this group of mines Mr. H. G. Bond, a well known capitalist and mining broker of Seattle, Wash., offered this spring $25,000 cash and $275,000 in September, but both parties seemed glad that the negotiations failed, though the owners are now very anxious to sell and would probably be glad to accept other terms.

The Slocan Star is in a more accessible position on the southern and opposite side of Carpenter Creek, but presents the same general features. Where the owners have commenced work they had made a cross cut of seven feet into the lode, exhibiting a fine body of galena measuring in all about 4 feet 6 in. in width, and several tons of ore were in the dump. According to the owners, average assays of this ore gave about 60 oz. of silver to the ton of galena. This lode or zone could be traced in the Creek some 700 yards away and 500 feet below; here it showed itself much wider, but apparently carrying only a very small percentage of lead and silver. No work had been done in this place, but the owners were taking energetic steps to drive a cross cut 100 ft. below their present outcrop, I hope and believe with every chance of their finding a fine deposit of ore.

The Freddy Lee is in the next canyon and on the same side of Carpenter Creek as the Slocan Star. It is at an altitude of 1,000 to 1,500 ft. above the stream, and on the course of a snow slide. Very little work had been done at the time of my visit, not enough to determine exactly if there was a lode or zone, or if it was only a "blow out" or pocket. On the dump formed by breaking up the croppings at this place, there were some 20 tons of galena, mostly of coarse cubes with occasional nodules of tetrahedrite (Fahlerz) which it is reported run very high in silver. Some 20 feet above where this work was done there is a narrow seam of ore some four inches in width, and the same is found about 30

feet below, but the lode is not traced or its dip or strike determined. James Wardner, the Lucky Jim of the Cour d'Aléne miners, and a local celebrity, who was once connected with the Bunker Hill and Sullivan mine, has bonded this property for $15,000, and had made a payment of $1,500 and was expected to do some development work and to ship the ore on the dump to some American smelting works, but there was no trail when I was there within about five miles of the mine.

The Lucky Jim is about 1,000 ft. above Bear Lake and presents the same general appearance as the other mines, it has been uncovered for about 30 ft. on the strike of the lode, the mineralized zone having a width with possibly 3½ ft. of galenite, where there is the best showing. No development has been done on this claim.

There are other groups of claims such as the Brennan camp and Jardine camp, but they do not claim to be of much importance.

The country is extremely rough, the mountains being from 6,000 to 9,000 ft. high, mostly with rocky summits, covered with snow till midsummer, but generally wooded high up the slope; the valleys are V-shaped. Snow slides are very frequent and the creeks have many falls and rapid declivities, and some may be used for water power, notably, Carpenter and Kaslo creeks.

Three rival trails have been cut, one hy the Government, one by the C. P. R., and one by the Kaslo Town Site Company, all of which are now finished and passable for mules. It is reported that the C. P. R. will make a waggon road from Nakusp to the head of Slocan Lake, but this can scarcely be finished and will probably not be begun this year.

The Slocan River Trail is 32 miles, from the crossing on the C. P. R. to the Slocan Lake; it is then probably 14 miles to New Denver by boat. The trail is fairly good and the grade easy.

The Kaslo Trail is 21 or 22 miles from Kaslo Lake to the Bear Lake at the summit, with a rise from 1,750 (Kootenay Lake) to 3,780 ft. at summit. There is an uncut trail from Bear Lake to the forks of Carpenter Creek, about 6 miles, which would connect with trail to New Denver. The trail is made about 6 miles beyond Bear Lake, round the mountain hog-back, and zig-zag up the mountain to the Payne mine, at a height of about 5,000 ft. The trail stopped there, about 2½ miles from the Noble Five group, because of the snow.

The Nakusp Trail I did not go over.

The season here when transport is feasible, is short, and the winters are long, but now that there are three trails into the mines, it is to be hoped that at least one will be kept open all the winter.

The smelter and concentrating works which are being erected at Pilot Bay will be, when completed, the finest in Canada, and equal to any in the United States. The concentrators will have a capacity of 100 tons a day, and the roasting furnaces will be able to treat 50 tons to 75 tons. In addition they are building a refinery which will separate the lead and silver.

There will be no difficulty in procuring the limestone and iron ore needed as flux, as there are beds of limestone in close proximity to the Blue Bell mine, and the ore from this mine in itself contains a good deal of iron; in addition a fine deposit of iron ore has been discovered opposite to the smelter, on the other side of the lake.

The Blue Bell mine, owned by the parties erecting the smelter, has been sufficiently developed to prove the existence of enough ore to supply the smelter, almost to its full capacity, for some years to come, and the ore is easily and cheaply mined, the tunnel coming out on the edge of the lake near the wharf, about eight miles north of the smelter. The ore is a galena, mixed with considerable quantities of iron pyrites and zinc blende, and will need concentration. It is argentiferous, carrying from 15 to 25 ounces of silver to the ton.

There is a large quantity of decomposed ore matter forming a talus at the foot of the hill in which the mine is situated; the limestone underlying the ore having been leached away, the overlying ore has fallen in, and has formed by double reaction oxides and carbonates.

Although the Pilot Bay smelter expects to depend mainly on the Blue Bell mine for its supply of ore, it will also be a custom smelter, and proposes to buy any lead or silver ores offered, and to give prices which, while leaving a fair profit, will encourage the extraction of ore. Next year there will be no excuse for any miners in the Hot Springs camp or round Kootenay Lake to remain inactive.

This smelter will depend at present on Montana coke or charcoal made in the vicinity, but they eventually look to the Crow's Nest Pass as their source of fuel.

The plans for the smelter were laid out before the discoveries at the Slocan last year, or doubtless another location would have been chosen, but it can smelt all the ores coming out by the way of Kaslo. Unfortunately the proposed railroad on the route is not of easy grade, and will be expensive to build, and the natural outlet is by Carpenter Creek to New Denver.

Canada has to thank the McKinley tariff for this American enterprise on her side of the line, and the same cause has led to the erection of many furnaces in Mexico, and the rich dry ores of Arizona and New Mexico are now taken to the poorer galenas of Mexico, and the silver is smelted there to the great benefit of the southern republic, and the injury of the American mining industry. The great smelters of Helena, Montana, and Butte City, have great difficulty in securing sufficient lead to flux the "dry" ores of Nevada, Idaho and Montana, and there is no reason, with proper enterprise, that Canada should not become a purchaser of these rich ores and a smelter of them in conjunction with her own silver and lead.

Up till now the smelters have only offered the miners London prices for the metals in their ores, less freight, insurance, etc., to an English port, and have had to charge high smelting rates from the heavy cost of labor and fuel. It is self-evident that lead or other metals can be brought to Montreal cheaper by ship from England than they can be brought by the C.P.R. from British Columbia, and they have claimed that there was no local market to speak of in British Columbia. Owing to the enterprise of the C.P.R. this state of affairs is now altered, as by their Pacific line of steamers to Japan and China the market of the east can be more cheaply reached by the product of British Columbia mines than any other route. The consumption in China of lead for lining tea chests alone amounts to nearly 10,000 tons per annum, and there is no reason why large manufactories of white and red lead should not be erected on the coast, and even India and Australia supplied by the manufactured article. It will be found too that the Californian market will prove a profitable one, notwithstanding the duty which is paid by the consumers, and not by the producers.

It must be borne in mind that the China market is a peculiar one, and great care should be taken to have the lead pigs of the same size and quality as those to which they are accustomed.

In this article I have dwelt particularly on the Slocan camp, as it is the newest and least known; but the whole country is teeming with mineral wealth, and development is not confined to this district. The Slocan camp promises, even now, in its infancy, to become a very large ore producer, judging from the prospects already found, and doubtless many more and equally good locations will be discovered, and from the high silver content of the lead, it should take rank as one of the largest silver producing camps in the world. Many disappointments will undoubtedly occur, but I have every confidence that there will be in time several silver mines of world-wide repute, if they are properly developed and judiciously worked, and I trust that Canadians will reap the profits.

There are several other very promising new mines in the Kootenay district, of which I may particularly mention the Tam O'Shanter, owned by Montreal parties, and since the date of my visit I have received word of several most promising prospects having been found.

I do not refer to the well-known Toad Mountain group, which includes the Silver King, for at the time of my visit Mr. Charles Roepel, a well known mining expert, was making a professional examination of the Silver King mine, and it is to be sincerely hoped that his report was favorable enough to induce the parties by whom he was employed to complete the negotiations and transfer this extremely valuable property to a syndicate or company which will have the means to exploit it. Should this be done, and the working of the mine prove a financial success, it will be the finest possible thing for mining in Canada generally, and British Columbia in particular. The ore of this mine is mostly bornite, a sulphide of copper carrying a large percentage of silver, and should it be treated on the spot, the erection of concentrating and electrolytic refining works will be necessary. These in the United States have had the greatest financial success, and should prove equally remunerative in Canada, while the products in the rough or manufactured would find their natural market in China or Japan.

In other districts there seems to be real mining activity. Mr. John B. Hobson, of the State Mining Bureau, San Francisco, and perhaps the best authority on hydraulic mining in the world, has been retained to report on the gravels of the Fraser and Thompson rivers, and has reported favourably on them; and I understand that hydraulic mining will be commenced at once. The platinum and gold deposits on the Tullameen and Similkameen rivers are attracting great attention and some are likely to pass into the hands of powerful companies. The same is true of the Okanagan and East Kootenay districts, and great developments are promised in the Boundary Creek district, where there are very rich deposits of copper and silver lead, and the late discoveries on Fish Creek are, I was informed, looking well, and some claims are being intelligently proved under the management of Mr. Fishburn.

In conclusion, I will state that never before since the early days of Nevada and Colorado excitement, was there such a chance of successful mining enterprise and investment as there is to-day in British Columbia, for enough has been proved and discovered to show the presence of the ore bodies of great extent and richness. The C.P.R., the Dominion and the Provincial Governments, are most anxious to assist the country's development and aid private enterprise in every way by the granting of land and the building of roads. A splendid market in China and Japan is within easy reach, and I believe that British Columbia in a few years will take its place as one of the largest mineral producing countries in the world.

Unveiling of a Monument at Westville, N.S.—On Saturday, 20th inst., a monument to the memory of the colliers who lost their lives in the deplorable explosion at the Drummond colliery in 1873, was unveiled in Drummond Park, Westville, Nova Scotia, with becoming ceremony. Speeches were made by Mr. John McDougald, Mr. Rod. McDougald, Mr. Hall, (the chairman), and by Mr. Charles Fergie, the highly esteemed manager of the Drummond colliery.

Mr. Robert Simpson, M.E., formerly manager for the Intercolonial Coal Company at Westville, has gone to British Columbia, where it is thought he will practice in the future.

Process of Manufacturing Alloys of Iron or Steel and Nickel.

We give below a brief description of the process of manufacturing nickel steel recently patented by E. F. Wood, of the Homestead Steel Works, who has assigned the patent rights to the Carnegie Steel Company.

The invention concerns, chiefly, the method of introducing the nickel into the presence of the melted iron or steel and securing its admixture therewith, and it consists in effecting the reduction of oxide of nickel in the presence of the fused iron or steel, either before or after the decarburization of the pig metal, by mixing the oxide of nickel with carbon and exhibiting the mixture to the metal fused or in the process of fusion, so that the nickel ore may be reduced.

The nickel oxide used may be any of the natural ores, or what is known as "artificial" nickel ore, which is preferable on account of the leanness of the natural ores, and generally analyzes about as follows:—

	Per cent.
Iron	23.870
Nickel	48.230
Phosphorus	0.007
Silica	1.900
Sulphur	0.264
Copper	trace.
Oxygen and earthy matter	25.729
Total	100.

The process of manufacture of this nickel steel differs only from the ordinary open-hearth or Bessemer process in the manner of introducing the nickel, which is thus accomplished:

The nickel addition is prepared by grinding or otherwise pulverizing the nickel oxide and then mixing it with powdered charcoal or coke in the proportions of about 1 part, by weight, of carbon with 3 parts, by weight, of pulverized nickel ore. If a lean natural ore is used, a smaller percentage of carbonaceous matter will be required, and if the proportion of nickel in the material used is greater or less than before mentioned the amount of carbonaceous matter should be correspondingly increased or diminished. The object of the carbon being to effect the reduction of the oxide of nickel, the exact proportions of carbon added being easily determined in practice. The nickel and carbon being intimately mixed, are formed into a plastic mass, with a sufficient quantity of some binding material, such as tar or silicate of soda, and this plastic material is formed into small masses, preferably bricks, which are compressed into a solid condition. The purpose of this pressure is to compact the materials, so that they can the more readily be kept immersed in the melted metal. It is preferable to previously dry the ore, so as to render the bricks more compact and to prevent the presence of water. The amount of oxide of nickel contained in these bricks can be readily determined by a previous analysis of the ore (natural or artificial) of which they are composed, and on the quantity of such bricks used with a given charge of metal will depend, of course, the percentage of nickel contained in the resulting product, which may vary in any desired degree, according to the character of the nickel-iron or nickel-steel to be manufactured, it being understood that an allowance should be made for the loss of about 10 per cent. of metallic nickel which passes into the slag and is lost. The amount of this loss varies, however, somewhat with the different processes of iron or steel manufacture.

The application of the process to the open-hearth furnace is thus described: The open-hearth furnace being suitably heated, a proper proportion of nickel-addition bricks are placed on the hearth, mixed with the charge of pig metal, which is so placed as to prevent the bricks rising to the surface of the metal as it melts, after which the open-hearth process is carried on in the usual way, the decarburization of the pig metal and its subsequent recarburization, together with the addition of spiegeleisen or ferro-manganese, being conducted in the usual manner. The effect of introducing the nickel addition in the manner described is that the oxide of nickel is reduced in the presence of the melting or melted pig metal, and the metallic nickel thus produced becomes intimately mixed with the iron, while the earthy and foreign matter of the nickel ore is melted and unites with the slag.

The process applies also to the use of the nickel addition in the basic process of decarburizing pig metal without any other change than the addition of the nickel bricks; and it is found preferable in the basic process to add the bricks after the addition of the limestone and before charging the pig iron, so as to bring the nickel bricks into more intimate contact with the melting iron or steel.

When used in connection with the Bessemer process it is perferable to introduce the nickel additions into the iron ladle as the molten pig metal is being charged into the converter, if the iron were hot enough at that stage of the process; but as this is usually not the case it is better to introduce the nickel brick into the Bessemer converter before the molten iron is charged, no other change in the conduct of the Bessemer process being required; or the nickel bricks may be added to the Bessemer metal in the steel ladle at the end of the process, the steel being blown hot enough to cause the complete fusion of the bricks, in which case the nickel ore will be at once converted into metallic nickel and mingled with the liquid steel.

Coal Mining at Lethbridge, N.W.T.

By Frank B. Smith, B. Sc., M.E., Anthracite, N.W.T.

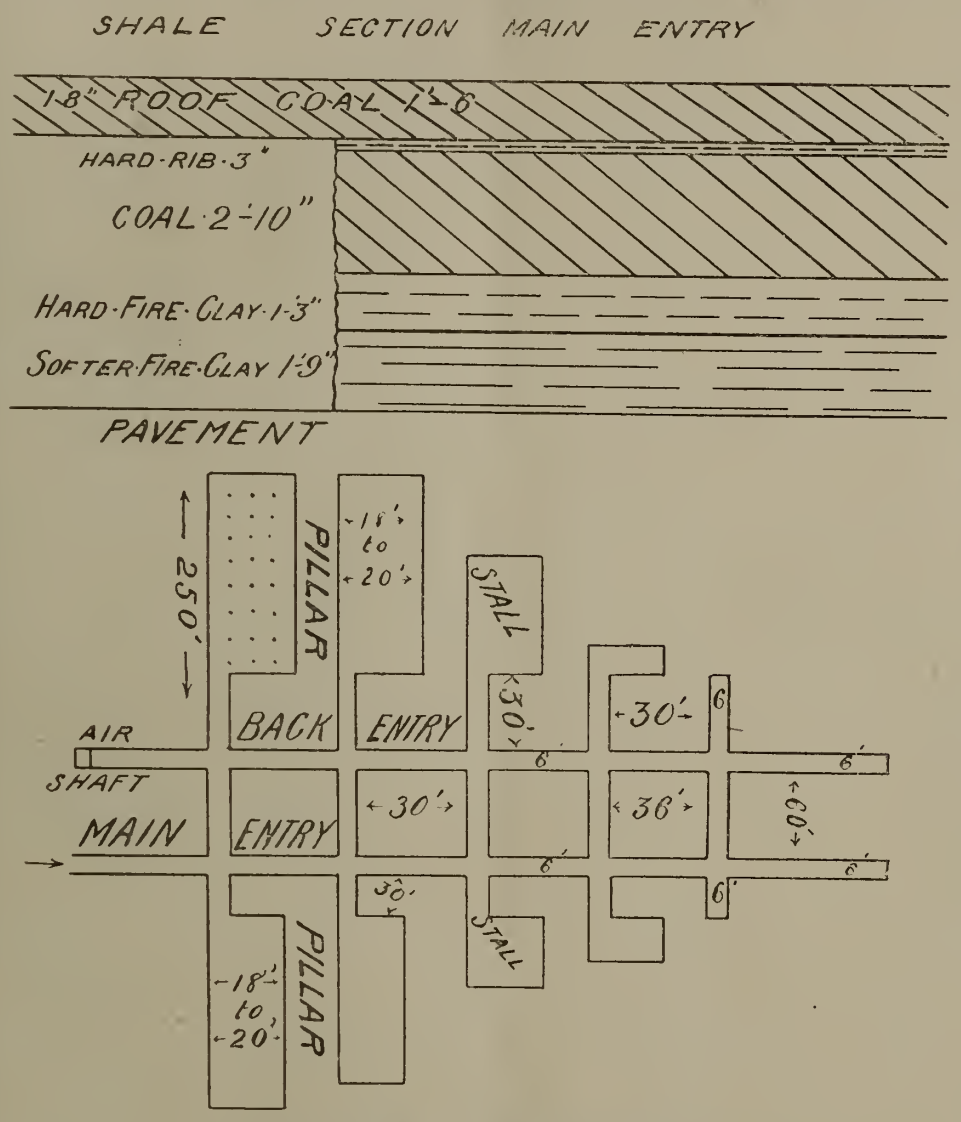
The railway to the Galt Coal Mines, operated by the Alberta Railway and Coal Company, leaves the Canadian Pacific Railway main line at Dunmore Station, and is constructed as a narrow gauge, running in a south-westerly direction for 110 miles to the town of Lethbridge, in Southern Alberta. A few miles east of this town another narrow gauge branches off to the south and crosses the line to the city of Great Falls, both lines being owned by the Alberta Railway and Coal Company. The town of Lethbridge is beautifully situated on the prairie close to the valley of the Belly River, where the trail crosses the valley to Fort McLeod. The town possesses some very substantial buildings, and has every indication of being one of the most flourishing in the North-West.

The mines are situated near to the town, and consist of entries made from the level of the valley, and four shafts sunk from the level of the prairie to the coal, a distance of about three hundred feet, and half a mile apart. From the river valley the coal can be seen cropping out along the banks and dipping generally in a north-west direction. From the valley there have been eight double entries working out the coal; all but two have, however, been worked out to the required distance for the economical working of the coal. The principal entry now at work is a stone drift for about one hundred and fifty yards, and driven at an easy gradient to strike the coal at a lower level. The system of working the coal in this district is by driving double entries, a main and a back entry. These again are connected by ends or rooms about thirty-six feet apart, to allow the air to circulate freely, and continue the working of the coal on the pillar and stall system. The main and back entries are driven six feet wide, and every thirty-six feet a room is branched off right and left, driven in the solid coal for thirty feet, and then opened out into a stall about twenty feet wide. The work is now carried on in a breast keeping the road close to the fast side of the place, the waste part of the working being partially timbered and filled in with dirt. The stalls are now worked forward at right angles to the main entry for a distance of about 250 feet; when this required distance of the stall has been reached by the miner, he opens out the full width of the place, about 36 feet, and takes out the pillar of coal to the waste of the stall, which has been previously worked to the required distance. The general section of the coal as wrought here is:

Shale.
Coal, 1′ 6″.
Hard Rib, 3″.
Coal, 2′ 10″.
Hard Fire Clay, 1′ 3″.
Softer Fire Clay.

The main entries are driven straight, and the roadway formed by leaving on the top coal for the roof and lifting about three feet of the fire-clay, making a roadway six feet high by six feet wide, suitable for pony haulage, which is the system adopted for drawing the coal from the mine. When the rooms have been formed and the miner has opened out the stall to the required width, the coal is broken up to the full height and carried forward in a breast, as previously mentioned. The mode of ventilation used in the entries is by a furnace built on the back entry, a shaft to the surface, surmounted by a chimney about 50 feet high, giving an adequate amount of air to all the miners. The coal is drawn from the river level to the bank head up a double track incline by a geared engine lifting eight hutches at a time, and weighing in all about 12 tons, not including the rope. When the coal has been landed at the bank head, it is tipped over screens into a waggon which stands on the platform of a weighing machine, and so the amount of each hutch is registered. The bars of the screens are respectively 1″ and ¾″ apart, and the slack which passes through the screens is landed in a pit, and again elevated by buckets and passed through a revolving screen with half-inch meshes. This revolving screen divides the coal into two classes, nuts and dross. Near to the bank head No. 1 shaft has been sunk to the coal, a depth of 275 feet, and in connection with it an air shaft has also been sunk, and to this shaft is fitted a Murphy fan 6 feet diameter. This fan will either exhaust the air from the shaft or force it down, as sometimes required by the state of the weather. The reversing of the current of air is made by opening or closing certain openings. The speed of the fan is usually about 200 revolutions per minute. The winding engines for No. 1 shaft are two 20 inch cylinders, direct acting, on a spirally grooved drum and excellent brake connection. The pithead frame, screening, and general arrangements at this shaft are of the most modern type, including a safety clutch on the cage, so that if the wire rope was breaking, the cage would only descend a few yards until the clutch acted on the guides of the shaft, stopping any further descent.

Nos. 2, 3 and 4 shafts sunk to the coal are all equally well equipped, so that should a greater demand take place for coal this company could on the shortest notice increase their output of coal to 1500 to 2000 tons of coal per day. The coal is of an excellent quality, and is used largely for steam raising purposes, being equally good for heating and cooking stoves.



Souris Coal Fields.

What a pleasing sound the mention of the above name must be to the ears of all, and especially commercial men, in Manitoba and the eastern portion of Assiniboia. The opening up of the coal fields in this part of the Dominion, so destitute of wood, will be one of the greatest boons that this part of the country has yet experienced. In the great city of Winnipeg, and all towns along the track to the coal fields, the general topic of conversation is the probable development of the new city of "Estevan," and these remarks usually interspersed with the never ending subject, the crops. The journey to the coal fields at present is a tedious one, but in a few months the Canadian Pacific Railway is sure to be running trains direct through to this promising town. Along the route from Brandon to Oxbow, the present railway terminus, are many flourishing towns, and the land for miles on either side of the track is well settled and cultivated. The distance from Oxbow to the coal field is about 42 miles, and this part of the railway has now been completed, although not yet open for passenger traffic; this distance is covered by stage, the trail following the construction line the greater part of the way. When within five miles of the coal fields there rises to the view a number of "Buttes," relieving to the eye the monotony of the level prairie. It is about one mile on the south side of these Buttes stands the present tent city of Estevan on Sec. 23, R. 8, Tp. 2. Here we find a mining, railway contractors' and surveyors' camps, also a wooden boarding house, livery stable, and a Jew's dry goods store. On the side of the Long Creek, which joins the Souris River a mile further south, are to be seen entries going into the side of the valley where the miners have been prospecting. Some of these entries are driven in the coal about 200 feet, and the coal as seen in them is of very fair quality, and an average thickness of eight feet. The bottom of the coal seam lies about forty to fifty feet below the level of the prairie, and from all appearance seems to lie very flat, or in some places may lie in troughs like the prairie. The pavement and roof of the coal seam is not what a practical miner would desire if he had the making of them, as they are both a trifle soft, but there is no doubt a system will be devised after experiment for the safe and economical working of the coal. The seam is of a woody structure and friable, which will render it a little difficult of transportation, but the system of dumping the coal direct from the mine into box cars, and from them to coal sheds or cellars, will obviate to a great extent the slacking that takes place when the coal is exposed to the atmosphere for any length of time. The coal burns extremely well, and leaves a light ash; there is no doubt that it will be largely used for heating and cooking purposes, and supersede the burning of wood, and to some extent the hard coal in this part of the country. About one mile to the south of the new town site, in the Souris Valley, are vast flats about 50 to 60 feet below the level of the prairie, and nearly one mile wide. These flats have been formed by the burning out of the coal at no very distant date, and the exposures of strata in the cliff shew that in conjunction with the coal are fine seams of clay suitable for brick making purposes. Here also good building stone is to be found, which will ensure that the great coal field city of the future will not be a wooden one, but good substantial buildings of brick and stone. Twelve miles further down the Souris River are two coal mines which have been in operation for a number of years, supplying all who liked to come to the mine for it at the moderate sum of $1 per load. The coal in these mines is also eight feet thick, and the entries run below the prairie about one hundred and fifty yards, with rooms branching right and left. The mining here has not been carried on in a systematic manner, but the quality of the coal is very fair, and seems to be harder than what has been already mined at the new coal fields, but in all likelihood the quality of the latter will turn out as good when the miners have penetrated a greater distance below the prairie. The company who have now taken up the enterprise of opening up the coal fields in the Souris district should assure the public that the undertaking will be gone on with in a systematic manner, and no money will be spared to try and make it one of the greatest successes ever attempted in this part of the country. The first car load of coal was shipped to Winnipeg on the 2nd ulto., and is to be sold there at the rate of $4 per ton.

Cost and Uses of Aluminium.—Alfred C. Hunt, President of the Pittsburg Reduction Company, does not encourage the idea that aluminium is to be made "dirt cheap;" but as he considers it probable that the price will be ultimately brought down to 18@20c. per pound, a cheapness is indicated which will have important industrial effects. One of the principal respects in which a lowering of the cost is expected is in the electrical energy required for the process of deposition, which now makes up one-third of the cost. Mr. Hunt thinks that the power to be developed at Niagara will prove "one of the best in the world for the manufacture of aluminium. A small percentage of aluminium makes a handsome bronze with a tensile strength of 80,000 pounds per square inch, while a limit of 130,000 pounds is attained and can be supported under contract. It is feasible to make a wire of aluminium, alloyed with silver, titanium or copper, which will have as compared with copper, weight for weight, an electrical conductivity 70 per cent. greater than copper. In view of the magnitude of the problem of transmitting electrical power, this declaration that the aluminium-titanium alloy will be the cheapest and most advantageous electrical conductor has a vast importance. The important qualities which this metal seems to possess are its relative lightness; its non-tarnishing quality; its extreme malleability; the ease with which it can be cast; its influence and value in alloys; its high comparative strength and elasticity; its high specific heat and its conductivity of both electricity and heat.

The Minerals of Ontario.

AN ADDRESS BY MR. A. BLUE, DIRECTOR OF MINES, TORONTO, TO THE STUDENTS OF UPPER CANADA COLLEGE, MAY 6, 1892.

Continued from page 120.

with those primary rocks, or those still older and formless rocks whence the primaries had their origin? To think on those themes, or seek to answer those queries is only to bring up afresh the questioning which came to Job out of the storm.

> Who is this that darkeneth counsel
> By words without knowledge?
> Gird up now thy loins like a man;
> For I will demand of thee, and declare thou unto me,
> Where wast thou when I laid the foundations of the earth?
> Declare, if thou hast understanding,
> Who determined the measures thereof, if thou knowest?
> Or who stretched the line upon it?
> Whereupon were the foundations thereof fastened?
> Or who laid the corner stone thereof;
> When the morning stars sang together,
> And all the sons of God shouted for joy?
> Or who shut up the sea with doors,
> When it brake forth, as if it had issued out of the womb;
> When I made the cloud the garment thereof,
> And thick darkness a swaddling band for it,
> And prescribed for it my decree,
> And set bars and doors,
> And said, Hitherto shalt thou come, but no further;
> And here shall thy proud waves be stayed.

We are appalled by the story of our earth's creation; yet it is befitting that we study it, and speculate upon it, and strive to understand it. Even in things too large for finite comprehension it is profitable to speculate and enquire if we do so in a spirit of reverence and of loyalty to truth, for the mind expands by the contemplation of the universe about us. But let us get on to the practicable and the knowable.

The primary rocks, embracing the Cambrian, Huronian and Laurentian systems, together with the igneous rocks which sometimes overflow them as trap, but are oftener extruded through them as veins and dykes, are the source of almost all our minerals. Of the primary rocks we know something. They make up the surface of a very large portion of our country, and small regions of them have been explored and studied with more or less care for many years. They are indeed of vast extent and volume, covering an area in Ontario alone of not less than 150,000 square miles. In the Dominion they reach from the straits of Belle Isle on the Atlantic to Demarcation Point on the Arctic ocean, and cover an area of 2,000,000 square miles. Their thickness has never been measured, and owing to foldings and tiltings it may be impossible to measure it, but one section of the Laurentian series north of the Ottawa river was computed by Logan to be 32,750 feet, or a little over six miles. By others the depth of the upper division of this formation is estimated at 100,000 feet or nearly twenty miles. The Laurentian mountains, which extend in a V-shaped line from Labrador to the region west of Hudson Bay, are the oldest in America; and upon both their northern and southern slopes in Ontario, but especially upon the latter, are stratified beds of successive ages which are no doubt the accumulations of sand and mud worn away by the action of ice and rains upon the mountain ranges during countless time.

"The destruction of the elevations in the Laurentian districts," Prof. Shaler says, "is so complete that we cannot make out the original trend of the several ranges; as in an ancient city where the devastation wrought by time leaves nothing but a confused ruin which we only know to have been the dwelling place of men by the nature of the materials, so this old mountain field can only be shown to have been at one period like the newer systems of the Cordilleras and the Appalachians by the waste of its former structures."*

If you examine a fragment of Laurentian rock under a glass, or even with the naked eye, you will observe that as a rule it does not consist of one mineral or element, but of a variety of metallic and non-metallic substances which enter into almost endless combinations. Of the sixty or more minerals found in this Laurentian series and its enclosing veins, there are twenty-three enumerated by Sterry Hunt which are constituents of the country rock as well as of the veins, including such important ores as apatite, serpentine, muscovite, quartz, magnetite, hematite, pyrite and graphite. Great limestone beds are interstratified with gneisses and quartzites in the formation, and disseminated through the limestone or arranged in parallel bands, in it are grains of specular and magnetic oxides of iron, scales of mica and graphite, and crystals of iron pyrites and apatite, all of which are sometimes met with also in large accumulations either in veins or running with the stratification.

In the Huronian and Cambrian systems the minerals are largely the same as in the Laurentian, from which they have been derived; but they also abound in dykes and are covered in places with extensive overflows of greenstone and basaltic trap, and are reticulated with mineral veins. They are pre-eminently the metal-carrying rocks of our province, and are for that reason of first importance from an economic point of view, or are by most persons so regarded. The Cambrian system is confined chiefly to the shores of Lake Superior, embracing the Animikie, Nipigon and Potsdam formations; but there is also an outcropping of the Potsdam in the eastern part of the province, from the River St. Lawrence below Brockville to the town of Perth in Lanark. The Huronian is much more extensive, consisting of a number of belts or areas from the upper waters of the Ottawa river to Lake of the Woods. The system has not yet been accurately mapped, but the largest belt is no doubt that which extends from Georgian Bay northeastward to the province line at Lake Temiscamingue, where it enters Quebec and continues to Lake Mistassini. Other important belts lie between Lake Superior and the western limit of the province, and these like the one north of Georgian Bay have their greatest length in northeast and south-west lines. The most extensive remaining areas are those in the upper basin of the Moose River and its tributaries, and in the region north of Lake Superior and east of Lake Nipigon. The mineral-bearing district of which the northern part of the County of Hastings is the centre was at one time supposed to belong to the Laurentian system; but its rocks are now by some geologists classed with the Huronian, and by others with a later series, the Taconian.

Rocks of the Silurian and Devonian systems, which constitute all the more recent formations in Ontario, have hardly been disturbed at all since their first deposition, except as changes of elevation or subsidence may have occurred slowly and uniformly over wide areas. Veins carrying small quantities of galena, copper and some other metals cut through the lowest Silurian formations in the eastern parts of the province, where thin beds overlie the Laurentian rocks; but no dyke or vein has yet been discovered in the sandstones, shales and limestones which cover to great depths the country between the great lakes. Mineral veins are most frequent in districts where eruptive rocks are abundant and are confined to certain areas of disturbance, and of these conditions the Silurian and Devonian rocks of western Ontario give no sign. Either they were laid down in a quiet period of the earth's history, or the region over which they extend was never seriously subject to the influence of disturbing agencies. It is a vast plain whose level is only broken by long and low anticlinals, and therefore, there have been no great movements to divert pressure from one part of the earth's crust to another, to find out lines of weakness and develop volcanic excitement along lines of fracture.

I would not, however, have you assume that there are no minerals where there are no veins. Iron ore is sometimes found in large deposits in regions where no veins occur; and although it has not yet been discovered in the Silurian or Devonian systems of western Ontario, except as the local coloring matter of certain strata, no one can definitely say it does not exist there. Salt is found in great abundance in beds of the Onondaga formation, and above it in parts of the same formation are extensive beds of gypsum. Of limestones, sandstones and clays, there are illimitable quantities, suitable for economic uses; and of all the minerals of those newer systems, salt, petroleum and natural gas excepted, the source is to be sought in the Archæan rocks of the north.

As far as known there are about 600 mineral substances in the crust of the earth, which are made up of the 64 or more elements found in the earth and its atmosphere. These elements are classed as gases, metals of the alkalies, metals of the earths, metals proper and non-metallic substances; but many of them must be exceedingly rare, since it is estimated that eleven of the number make up 99 per cent. of the earth's crust. One of the gases, oxygen, forms one half of the whole; silicon, a non-metallic substance, one quarter; aluminium, a metal of the earths, one tenth; calcium and magnesium, two other metals of the earths, 8 per cent. of the whole; sodium and potassium, metals of the alkalies, 3.6 per cent.; carbon, iron, sulphur and chlorine together, 2.4 per cent.; and all other bodies one per cent. Of the compound bodies silica constitutes 53 per cent. of the whole; alumina 19 per cent.; and lime, magnesia, soda and potash, 17 per cent.; leaving the combinations of oxygen with carbon, iron, sulphur and chlorine to make up 7.5 per cent., and with other bodies 3.5 per cent. It thus appears that the metals proper constitute only a very small part of what we know as minerals: and in no corner of the globe are they so generally diffused as to form any great bulk of it, although some areas are vastly richer in the metallic ores than others.

No one can undertake to give an exhaustive account of the minerals of our province, for the sufficient reason that only a small portion of it has been explored. Fifty years ago the work of the Geological Survey was begun by Sir William Logan, with a small staff; but the labors of the Survey were spread over the whole of Upper and Lower Canada. Twenty-five years later the area was extended by Confederation to the Maritime Provinces, and in five years more the country was taken in from ocean to ocean, embracing a land area of 3,315,000 square miles. Logan's survey of Ontario did not extend northward beyond the height of land, and indeed a very large part of the Ontario of our day, northward and westward, was not supposed to lie within its boundaries a quarter of a century ago. Since then other portions of the Dominion have demanded the attention of the Survey, and the result is that little has been added to our geological knowledge of Ontario since the publication of Logan's Geology of Canada in 1863. Small sections have been surveyed with more or less care. Hunt made a report on the Huron salt district, Vennor on the Hastings district, Lawson on the Lake of the Woods, Ingall on the silver-bearing rocks of Lake Superior, and Bell on the Sudbury district. Other larger territories have been explored in a general way, but not so as to supply very definite or practical information on the character of their ores or minerals. Bell's report on the Hudson Bay district will answer for illustration; an exhaustive report on so extensive a region could not be made on the observations of two short seasons of field work. His more recent report on the geology of the Sudbury mining district is based on the labors of three seasons, and embraces a tract 72 miles long by 48 broad, or 3,456 square miles. Now at 130 working days in the season a thorough survey would require the covering of nine square miles per day, which is far more than could be accomplished under the most favorable circumstances. But see what the difficulties were as described in the report.

"Rocky ridges and boulder-covered slopes, alternating with swamps and small lakes, are the rule over the greater part of the area. In most parts the boulders are not only thickly scattered over the uneven rocky surface, but are often piled on top of one another without any finer materials between them. The trees which originally grew between and even on top of the boulders have generally been killed by forest fires, and their trunks have fallen over them in every direction. A second growth thicket of small prickly spruces entangled with tough young birches has sprung up among the boulders and resists the explorer's progress like a continuous hedge. This, together with the uncertain footing, due to the boulders and the net-work of prostrate trunks, renders it very difficult to make one's way through these obstructions. Indeed it sometimes became impossible to do so until we had first chopped a passage through them."*

With such hindrances to exploration large portions of the field must have escaped notice, and so the report cannot be assumed to deal fully with the ores and minerals of the district. It is possible that there are many metalliferous veins and ranges in those two and a quarter millions of acres of his sheet which the geologist either passed over unobserved or did not cross at all. The late Alexander Murray spent a year in surveying the district between Lake Wahnapitæ and the mouth of Whitefish river on Lake Huron, yet only the barest mention is made in his report of a sign of the nickel ore which within the last six years has made the name of Sudbury famous in America and Europe. Not one-tenth part of the province has been explored, we are told by the head of the Geological Survey, although the work has been carried on by the government for fifty years. Therefore we are forced to speak in a qualified way on the extent and value of its mineral resources. We know that they are considerable by the number and variety of discoveries which have been made and proven. They may be vastly greater, but that can be determined only when the whole area has been gone over, and 200,000 square miles is a very large territory to be scanned by the geologist's eye or sampled by his hammer. Fortunately his labours are being supplemented by the explorer, and in recent years the explorer has developed not a few of the qualities of an expert. Accordingly I feel sanguine that the ratio of progress in knowledge of the geology of our province will soon be increased, and that we shall not have to wait five hundred years for a completion of the survey.

I propose now to pass in review, as concisely as may be, some of the principal ores and minerals of the province, their places of occurrence, and the extent to which these resources of our natural wealth have been developed; and for convenience I shall group them under the following heads, viz: I. Metals and their Ores; II. Structural and Decorative Materials; III. Mineral Pigments; IV. Mineral Fertilizers; V. Refractory Materials; VI. Salt and Mineral Waters; VII. Materials of Light and Heat.

I. Of the principal metals we have, in alphabetical order, aluminium, arsenic, copper, gold, iron, lead, nickel, silver and zinc, one or two of which are sometimes found in the native or metallic state, but all of them in chemical combination with other elements in the form of ores and earths. Often they occur in veins traversing the crystalline rocks and in the rocks themselves, frequently as deposits and impregnated beds, and sometimes, but very rarely, in alluvial clays, sands or gravels. How the metals came to occupy veins or the country rock, and whether they came as elements or compounds, no one can tell. We can speculate on their source, and there are many theories,—so many, in fact, as to suggest the story of the young candidate at a civil service examination. "How did you succeed my son?" his father asked. "O pretty well, father, I guess. I answered one question I am sure." "And what was that?" "Well, they asked why Charles I. was put to death? and I answered that I didn't know." As to the metalliferous veins there are theories of contemporaneous formation, of igneous injection, of electric currents, of aqueous deposition from above, of sublimation, of lateral secretion and of ascension. Prestwich says that by Werner and his school "They were supposed to have been introduced in a state of solution from above; by others they were supposed to have been injected simultaneously with the opening of the fissures from below; but the more general opinion of geologists now is, that they are the deposits formed during lengthened periods by thermal mineral waters or by sublimation." And again he observes that—

"Ordinary mineral veins were no doubt fissures in which there were cavities or spaces left open for a length of time, and in the interstices or on the sides of which were gradually deposited a variety of minerals and of metallic ores. The banded structure of some veins, and the fact that the minerals are such that could be deposited in water, tend to prove that their formation has been in most cases due to thermal waters, rather than to sublimations of gases and vapors such as are now discharged in the solfataras of volcanic districts. It is possible that in some instances such emanations may have contributed to a particular

*The Story of our Continent, p. 99.

*Report on the Sudbury Mining District by Dr. Robert Bell, p. 7 F.

result, but in the majority of cases the phenomena agree better with the hypothesis of aqueous solution."*

Sir Archibald Geikie in discussing the various theories of origin says:

"The structure and characteristic mineral combination of metalliferous veins are precisely such as would be produced by deposition from aqueous solution. There can hardly be now any doubt that the contents of these veins have generally been deposited by water. But the source from which the metals were derived is not so obvious. The fact that the nature and amount of the minerals, and especially of the ores, in a vein so often vary with the nature of the surrounding rocks shows that these rocks have had an influence on the precipitation of mineral matter in the fissures passing through them, if they were not themselves the source from which the metals were obtained; for, as already remarked, the presence of the heavy metals has now been detected in rocks of almost every kind and age. On the other hand, in some volcanic districts at the present time, various minerals, including silica, both crystalline and chalcedonic, metallic sulphides, and even metallic gold, are being deposited in fissures up which hot water rises. Each of these modes of origin may in different cases have occurred. It is almost certain, from what we now know of the diffusion of metallic substances, that there must be a decomposition of the rocks on either side of a fissure, perhaps to a great distance, and that a portion of the mineral matter abstracted will be laid down in another form along the fissure walls. If, on the other hand, the rocks on either side of the fissure are permeated for some distance by hot ascending waters, holding such metalliferous solutions as have been detected in the hot springs of California and Nevada, some of the dissolved mineral substances will doubtless be deposited in the fissure, and may even be introduced into the pores and cavities of the adjacent rocks."†

Sterry Hunt's theory is set forth as follows:

"The metals . . . seem to have been originally brought to the surface in watery solutions, from which we conceive them to have been separated by the reducing agency of organic matters in the form of sulphurets or in the native state, and mingled with the contemporaneous sediments, where they occur in beds, in disseminated grains forming fahlbands, or are the cementing material of conglomerates. During the subsequent metamorphism of the strata these metallic matters being taken into solution by alkaline carbonates or sulphurets, have been redeposited in fissures in the metalliferous strata, forming veins, or, ascending to higher beds, have given rise to metalliferous veins in strata not themselves metalliferous. Such we conceive to be, in a few words, the theory of metallic deposits; they belong to a period when the primal sediments were yet impregnated with metallic compounds which were soluble in the permeating waters. The metals of the sedimentary rocks are now, however, for the greater part in the form of insoluble sulphurets, so that we have only traces of them in a few mineral springs, which serve to show the agencies once at work in the sediments and waters of the earth's crust."‡

And Arthur Phillips, after demonstrating the almost universal presence of heavy metals in rocks belonging to every geological period, states his conclusions briefly in these words:

"There can be no longer any doubt that the filling of veins has often been derived, in a state of chemical solution, from the surrounding country rock, and the theory of lateral secretion appears to explain more satisfactorily than any other certain phenomena not otherwise easily understood. It moreover not only accounts in a satisfactory way for the changes which take place in metalliferous veins when passing from one formation into another, but it also affords a reasonable explanation for the fact that shoots of ore usually follow the dip of the enclosing rocks."

This relation of ore bodies to surrounding rock was illustrated in the Silver Islet mine, to which I shall again refer, and has long been familiar to miners. The famous Dolcoath mine in Cornwall changed from copper to tin some forty years ago, and in both Cornwall and Devon it has been observed that some lodes yield tin where they cross granite, and copper where they traverse slate, changing from one metal to the other as they cross from the one rock into the other. In the north of England, again, the galena is most abundant in the limestones and scarcest in the shales, and Geikie mentions the fact that the veins in the Great Limestone, as it is called, which is 150 feet thick or less, have yielded as much lead as all the rest of a mass of 2,000 feet of strata put together.

The question of the origin of metals as found in veins and in the country rock has not been solved, but I thought it might interest you to be told what theories are held respecting it, as well as some peculiarities concerning the occurrence of metals and their ores.

ALUMINIUM IN ONTARIO—ITS HISTORY AND USES.

As to aluminium, the first of my list, the theory of its origin is not a matter of so much doubt as that of most other metals. Yet it is never found in a free state in nature, and although by great odds the most abundant of all the metals—being estimated to make up a tenth of the earth's crust—it is one of the most modern in respect of discovery. A great French chemist, Lavoisier, suspected its existence about a century ago as the metallic base of alumina, but not until 1827 was it isolated for the first time. Then, however, it was obtained only as a metallic powder; the first ingot was cast in 1854. Alumina itself was not named until 1760, when it was obtained by calcining alum. We find it in many forms and combinations. It is the basis of all clays, and when crystallized in six-sided prisms it is called corundum, the clear and blue varieties of which constitute sapphire and the red varieties oriental ruby. Alumina is one of the chief components of felspar, which is a mineral generally of igneous origin, erupted from below the sedimentary strata. Felspar itself is one of the components of granite and syenite; but occasionally it is found separate and in large masses, as in parts of the counties of Frontenac, Leeds and Lanark. It is very generally diffused in rocks of the Laurentian system. Exposed to atmospheric influences the soda and potash felspars are altered to kaolin or china clay, but generally the admixture of lime, iron and other impurities on this side of the Laurentians has produced the common clays of our farmland. In localities on the other side of the Laurentians, especially on the Missinaibi and Abittibi rivers on the Hudson Bay slope, there are extensive deposits of a very pure kaolin which, when reached by railway communication, will prove to possess great economic value. Doubtless you sometimes wonder at the lightness and strength of porcelain or chinaware, but wonder will cease when you know that it is made up largely of the metal aluminium. The sample of this metal before me, which is 8 inches long, 4⅔ inches wide, one inch in thickness and weighs only 3 pounds 8½ ounces, was smelted from a charge of kaolin in a crucible. As made by the first process thirty-eight years ago, aluminium cost its weight in gold. Six years later it was produced at a cost of $8 per pound and the selling price was $12, at which price it remained for twenty-five years. In 1885, by the application of electricity, the cost of production was reduced to $1 per pound; and by an improvement of the electrolytic preparation the cost in the following year was further reduced to fifty cents per pound, the selling price now being seventy-five to ninety cents per pound. By this last process it is claimed by Prof. Richards, instructor in metallurgy at Lehigh University, that "the electrolytic preparation of aluminium has reached its climax of simplicity." In an article in the January number of the *Cosmopolitan Magazine* Prof. Richards says:

"The electrolytic processes for pure aluminium will be developed, but not radically changed. Details will be improved, but in principle they have reached their maximum development. It is unlikely that by them aluminium will ever be made and sold at a fair profit much below its present selling price. It will be several years before this maximum development is reached, and then the aluminium industry, metallurgically speaking, will again be at a standstill. The next upheaval after this will be the discovery of a process using neither sodium nor electricity, a purely metallurgical one, simple, rapid and cheap, by which aluminium can be produced at a cost of five to ten cents a pound. The writer hardly looks for this within the next fifty years, but before the next century has run its length such a process will be in operation."*

Well, the truth of an old adage finds here another illustration: It is never safe to prophesy unless you know. A purely metallurgical process has already been discovered, a sample of what it can accomplish is the block of aluminium before me, and I am assured that at a selling price of twenty-five cents per pound there is a fortune in it for the inventor and the producers. As to its uses in the arts, these will depend on its qualities. It is light, being only 2.6 times heavier than water, while iron and steel are 7.8 and gold 19.3 times heavier than water respectively. A cubic foot of aluminum weighs 163 lbs., while a cubic foot of iron or steel weighs 487 lb., and of gold 1,206 lb. It is strong, the tensile strength per square inch being 26,800 lb., while that of cast iron is 16,500 lb., of wrought iron 50,000 lb., and of steel 78,000 lb. It is feebly magnetic, it has no sensible taste or odor, it may be forged or rolled like gold or silver, it is ductile, it is fusible, and it is almost non-corrodible, neither air nor water nor sulphuretted hydrogen nor sulphuric acid having an appreciable effect upon it; besides which it has most valuable properties as an alloy with other metals. In his excellent work on Aluminium, published two years ago, Prof. Richards says:

"Whatever its price it can only replace gold or platinum because of its lightness; it already replaces silver, especially because of its resistance to sulphur, as well as for its lightness, besides being cheaper; it can only replace the common metals, at its present price, for uses where its lightness is an extraordinary advantage. But when its price is down to that of these baser metals it will begin to replace them by virtue of its other superior qualities, chemical and physical; aside from its lightness it will win a large field simply in comparison with them on its merits as a metal. Thus there are wide applications now almost unthought of, because the high price has been a blank wall to stop its use, but as it cheapens more and more we hear every day of new uses brought to light. Thus its sphere will widen until, since its ores are as cheap as those of iron, it will be approximate in utility to that universal metal. . . . When aluminium becomes cheaper it will without doubt be used for culinary articles of many kinds, replacing copper and tin vessels, for it is attacked to a less degree by the acids and salts ordinarily found in food than either of those metals, and possesses the great superiority that if dissolved its salts are not poisonous like those of copper or tin, being, on the contrary, perfectly harmless. The sulphurous acid of the air or of the products of combustion likewise leave aluminium untouched, while they quickly blacken silver."*

And in the article in the *Cosmopolitan*, from which I have already quoted, the same authority says:

"It has been discovered that many of the alloys of aluminium with other metals have very remarkable properties. For instance, five or ten per cent. of aluminium added to copper forms a beautiful bronze of a golden color and as strong as ordinary steel. A small portion of copper or titanium added to aluminium makes it much stronger without increasing its weight perceptibly. It is these alloys which may replace steel for many engineering purposes, for they approach steel in strength and yet are very little heavier than aluminium. Again, a very small amount of aluminium has a decidedly beneficial effect on cast iron, so that many founderies are using it, while for the difficult process of making steel castings aluminium is coming to be regarded as almost a necessity. Hundreds of pounds are being used weekly for this purpose."†

I have said so much on aluminium that I must necessarily be very brief in referring to other metals and their ores; but I have done so (1) because this metal is less known than most of the others, (2) because it is a metal of great promise, and (3) because it appears likely that no other part of America is so rich in the ores or earths from which aluminium may be extracted as our own province.

Arsenic is not a metal of high commercial value, it is not consumed in large quantities, and our supply of it in Ontario in the form of the white oxide far exceeds the call of the market. It is one of the components of the mispickel ores in the County of Hastings, and I believe that a sufficient quantity was produced at the Deloro gold reduction works when these were in operation several years ago, to meet all requirements to the present time.

Copper is found in various localities, on the north shore of Lake Huron, on the east shore of Lake Superior and elsewhere, generally as copper pyrites in quartz veins traversing greenstone or diorite, as at the Bruce and Wellington mines; but sometimes native and in sulphurets, in amygdaloidal trap, conglomerate and sandstone, as at Mamainse peninsula and Michipicoten Island in Lake Superior, and at points on the mainland along the north shore of this lake. It may be noticed here, and the fact has an important bearing, that microscopic observations made by the late Prof. Irving of the United States Geological Survey have established a complete identity between the Michipicoten island rocks and those of the typical copper-bearing districts of the south shore of Lake Superior in which are situated some of the largest and richest copper mines in the world.‡ Copper ore is found in many other parts of the province besides those already mentioned, but perhaps in the greatest quantity in association with nickel in the Sudbury district. For thirty years, ending with 1875, copper mining on a large scale was carried on at the Bruce mines; and Mr. William Plummer, who had charge of the works for a number of years, has estimated the value of the product of these mines at between $6,000,000 and $7,000,000. Operations at these mines were discontinued owing to the low price of copper and have not since been resumed.

ARGENTIFEROUS GALENA.

The ore of lead, galena, usually carries a small percentage of silver. It occurs in veins, the greater number if not all of which in this province are found in rocks of the Huronian and Cambrian systems. Mines have been opened in the Counties of Lanark, Frontenac and Peterborough, and smelting works have been erected at Kingston and near Carleton Place, but owing to wasteful management in one case, and to a limited supply of ore in the other these enterprises failed. There are rich veins near Garden River, in the district of Algoma, which were worked about ten years ago; and although considerable quantities of ore were raised, stamped and shipped, the lack of capital and markets led to the works being closed at the end of three or four years. On the north shore of Lake Superior, near Black Bay, a number of veins have been discovered, as also in the district of Nipissing, near Lake Temagami.

GOLD AREAS.

We have gold-bearing ores in many localities, as in the Hastings region, in the Sudbury country, in the valleys of the Thessalon and Mississaga rivers north of Lake Huron, on the north shore of Lake Superior, near Lac-des-milles-lacs, and on the islands and mainland of Lake of the Woods. Gold occurs almost always in quartz veins, in rocks of Huronian age; but sometimes it is said to be found in bands of slate, as on a location near the Vermilion river, west of Sudbury. Gold mining in Ontario has never been a profitable business, although fine specimens showing free gold are often exhibited by prospectors and real estate miners; but locations now being worked on Lake of the Woods, in the County of Hastings and in the Sudbury district are claimed to be full of promise. Reduction works recently started in the two regions first named are likely to prove the value of the ores, which as a rule are hard to treat. As illustrating the deceptive qualities of veins supposed to be gold-bearing, I may mention that of 96 specimens examined by the chemist of the Geological Survey, particulars of which

*Geology, Chemical, Physical and Stratigraphical, by Prof. Joseph Prestwich, vol. 1, pp. 334-5.

† Text Book of Geology, p. 590.

‡ Chemical and Geological Essays, 3rd ed., p. 220.

‖ A Treatise on Ore Deposits, p. 85.

* The *Cosmopolitan Monthly Magazine*, January, 1892, p. 284.

*Aluminium: its History, Occurrence, Properties, etc., by Joseph W. Richards, M.A., 2nd ed. pp. 367-9.

† The *Cosmopolitan Magazine*, January, 1892, p. 286. The statement that these alloys are very little heavier than aluminium can hardly be correct, except in cases where the latter metal constitutes the principal part of the alloy.

‡ The Copper-bearing Rocks of Lake Superior, by Roland Duer Irving, pp. 341-7.

are given in the last report of the Survey, 46 contained neither gold nor silver, 13 showed traces of gold and 4 of silver, while of the remaining 33 there were 21 which contained gold and 18 silver, some specimens showing both metals. Yet of those 96 specimens 73 were collected by officers of the Survey, thus proving the truth of a saying common among miners that "A great many other things are mistaken for gold, but gold is never mistaken for anything else."

IRON DEPOSITS.

Ores of iron are abundant in the Laurentian and Huronian formations, chiefly as magnetite, but sometimes also as hematite and limonite. In the eastern part of the province there are large bodies of magnetic ores in the counties of Peterborough, Hastings, Frontenac and Lanark, some of which are of excellent quality; but sulphur is often present, and occasionally titanium, both of which are very objectionable substances in combination with iron. Yet it seems likely that methods will be found to get rid of both sulphur and titanium, or to greatly reduce their proportions in the ore, in which direction very marked progress has recently been made by a process which consists in crushing the ore and cleansing it at one operation with a flow of water and a magnetic separator. Limonite, the brown ore, is found in Peterborough, and hematite, the red, in Hastings and Lanark. Hematite ore also exists in what is believed to be large quantities on the north shore of Lake Superior. Farther west, on the Mattawan river, a range containing specular and magnetic ores is found which is supposed to be a continuation of one or other of the great ranges of Minnesota —the Mesabi and Vermilion. Other ranges of magnetic ore, which are described as of vast extent, lie along the Atik-Okan river, a tributary of the Seine, which flows into Rainy lake. These ranges have been traced a length of ten or twelve miles, rising in places 200 feet above the plain, and the ore is said to be very rich and clean. There are many other outcroppings of iron ore besides the ones I have mentioned; yet it has to be confessed that there is not a working mine in the province, for which the only consolation is that we have got the ore still, and that it may perhaps be more valuable in some day to come, when other great deposits in America are worked out.

NICKEL RESOURCES.

Nickel is the most important of all our ores, and there are inexhaustible supplies of it in the country north of Georgian Bay. Nearly fifty years ago nickel was found with copper on what is known as the Wallace location, near the mouth of Whitefish river. It was found also on Michipicoten Island; but at neither place is it known to exist in workable quantities. The construction of the Canadian Pacific Railway led to the important discoveries that have been made in the district of which Sudbury is the centre. A railway cutting through one of the rocky ranges exposed the ore, which at first was supposed to be copper pyrites, but which, six years ago, was ascertained to carry nickel as well as copper. Explorations and workings made since have resulted in proving that the Sudbury district is richer in nickel ore than any other known part of the world, and two engineers of the United States navy department have reported 650,000,000 tons of ore in sight. The data from which this estimate was computed may not have been absolutely trustworthy, but we know that other large and rich discoveries have been made since those engineers visited the district, and there can be no doubt of the vast extent of the ore. Eight mines are being worked, three large smelting plants are in operation, and as the demand is said to far exceed the supply the reports we hear of enlarged development of the mining and smelting industries of the Sudbury field will find ready acceptance. The value of nickel when united with steel, producing an alloy which combines hardness with strength and freedom from fracture under the strain of heavy blows, has been so amply demonstrated that the secretary of the United States navy department has decided to construct the armor plate of all his battle ships with it; and the British admiralty has recently decided to use it largely for the same purpose, extensive orders having been placed for nickel-steel armor which forms the secondary defence of the battle ships now in progress. There are various other objects for which this alloy is well suited, such as in the making of cannon, small arms, boilers and machinery, cutlery, etc., where strength, malleability, capacity to take a fine polish and freedom from rusting are valuable properties. Besides, there are many uses in the arts to which the pure metal may be applied when produced cheaply and in large quantity; so that we may look forward with confidence to great activity in the working of the nickel mines of this province, and, possibly as growing out of it in a natural way, to the awakening of our dormant iron mining industry also.

SILVER MINING.

The silver-producing district of our province is confined almost exclusively to rocks of the Animikie series in the Cambrian system, lying to the north and west of Thunder Bay in Lake Superior. The veins which carry silver are found cutting ranges of table-topped hills or mountains whose summit is basaltic trap and whose base is black slate. Underlying the slate are beds of chert and jasper of extreme hardness which contain a percentage of iron, and it is found that the mineral veins in these beds are much leaner in silver than in the slates. The observation of this fact has depreciated to some extent the value of silver mines in the district, but recent accounts give rise to the hope that beneath the cherts the veins become enriched again. Silver Islet mine, which lies in Lake Superior south of the Thunder Cape promontory, was one of the earliest discoveries in that region, and from its opening, in 1870, to the suspension of work in 1884, the value of the silver output was $3,250,000, the total depth reached being 1,230 feet. Although the vein of this mine has been explored on the mainland for about a mile, no silver ore has been found; the only productive part of it is at the intersection of the dyke which constitutes the islet, and out of which the silver is supposed to have been deposited. Other mines in this district, the best known of which are the Beaver and the Badger, have yielded large quantities of ore during the last four or five years, but if they have been worked profitably the fact has been carefully concealed. It may require more capital and skill than have yet been employed to give them a thorough test.

There are other metalliferous ores in the province, but I shall refer only to one other, viz., blende or the sulphide of zinc. A large vein of it exists on the White Sand river about ten miles from the north shore of Lake Superior. This was discovered eleven years ago, and it is claimed that the ore may be mined with great facility, but for want of a road it cannot be brought to market. A specimen analysed by the chemist of the Geological Survey gave 54½ per cent. of zinc. Another vein has been discovered a short distance from the head of Thunder Bay.

STRUCTURAL MATERIAL.

II. In structural and decorative materials Ontario is richer than most countries, both as regards variety and quality. Sandstones, serpentines, marbles and granites abound in the northern districts, while in the south we have sandstones, limestones, clays and the materials for the manufacture of cement. Native cements are obtained from limestones in the Niagara formation at St. David's, Thorold and Limehouse, and in the Trenton at Napanee Mills. Portland cement is now being manufactured out of shell marl, large quantities of which are found deposited in shallow or extinct lakes, the marl being mixed with certain proportions of clay of a suitable quality, after which it is baked in a kiln and ground to a fine dust. Clay for common brick and tile is taken from deposits of the Saugeen and Erie clays; while for the manufacture of pressed brick and terra-cotta, the shales of the Medina and Hudson river formations are used. The brown Medina shale, which crops out along the base of the Niagara escarpment at frequent points between the Niagara river and Owen Sound, has a depth ranging from 400 to 600 feet. The Hudson river shale crops out along the valley of the Don and Humber rivers, and is probably of as great thickness as the Medina, although not so accessible. A few years ago all the pressed brick used in Ontario had to be imported from Ohio and Pennsylvania, but a better quality may now be produced at home. Its introduction is bound to greatly improve the architecture of our towns and cities.

MINERAL PAINTS.

III. Mineral pigments of natural paints are obtained in a number of localities, and some of them are very abundant. Sulphate of barytes is used as an adulterant with white lead. It is found in many of the veins on the north shore of Lake Superior, and sometimes, as on McKellar's and Jarvis islands in Lake Superior, makes up a large part of the vein. In the eastern part of the province, but especially in the county of Lanark, there are numerous veins of this mineral. Ochres are clays of various colors, such as red, yellow and green. At Limehouse on the Grand Trunk Railway, a variety of colors is obtained, and pigments have been manufactured there for many years, as also at a point in the same formation farther south in the township of Nelson. Yellow ochre is a mixture of clay and limonite or the brown ore of iron, while red ochre is a mixture of clay with the specular or hematite ores of iron. Large deposits of the latter of fine quality are found in the counties of Lanark and Frontenac, one of which is 30 feet wide and three-quarters of a mile long; while another, which has a rich bronze hue, has been explored with a diamond drill to a depth of 65 feet.

PHOSPHATE AND GYPSUM.

IV. Mineral fertilizers exist as marls, gypsum, and apatite or phosphate of lime. The last named occurs as veinstone in the upper rocks of the Laurentian formation in various parts of the counties of Frontenac, Renfrew, Leeds and Lanark, but mining has been carried on chiefly in Frontenac and Lanark. The mineral is rich, but it is difficult to mine, and most of the deposits are remote from railway communication. During the past year the industry suffered partial collapse owing to the discovery and working of large deposits in Florida and the shipment of great quantities to the European markets. Gypsum is found over a large area in the Onondaga formation which underlies the counties of Brant and Haldimand, where mines have been worked for half a century. As plaster of Paris it has been largely used as a fertilizer for grass land, and when calcined it is used to furnish and decorate walls. There are very extensive deposits also on the Moose river and its tributary the Missinaibi.

SALT BRINES AND MINERAL WATERS.

V. Mineral waters and rock salt are of limited occurrence in Ontario, but while the latter occupies one field, the former are found in a number of localities and at points far distant from each other. Salt beds in the Onondaga formation extend over an area of 1,200 square miles in the counties of Bruce, Huron, Lambton and Kent. These beds no doubt were originally deposited at the bottom of inland seas as their waters gradually dried up. The total depth of the beds in Huron is about 100 feet, gradually thinning out to the edge of the basin; but a boring near the River Thames in Kent, is reported to have gone through one bed of white salt 171 feet in thickness. The supply is sufficient to last our province for centuries; yet it is small when compared with some other known deposits of rock salt, such, for example, as the massive accumulations at Sperenberg, near Berlin, which have been bored through to a depth of 4,200 feet, or those of Wieliezka in Galicia which are more than 4,600 feet thick. The annual make of our Ontario wells ranges from 350,000 to 400,000 barrels, and owing to the restricted market this limit of production was reached nearly twenty years ago. Mineral waters impregnated with sulphur and salt are found very generally in the western part of the province, when deep borings are made in rocks of the Upper Silurian and Devonian systems; whereas in the eastern section of the province they are alkaline waters and are found to issue from rocks of the Lower Silurian system.

GRAPHITE, MICA, AND ASBESTOS.

VI. Refractory minerals are such as require an extraordinary degree of heat to fuse them, or as are altogether infusible, among which may be named actinolite, asbestos, graphite, mica and talc or steatite. These are found in commercial quantities in the eastern counties of the province, in rocks of the Laurentian formation. They have not yet, however, been worked upon a large scale, with perhaps the exception of mica. This mineral, from its possessing good insulating properties, has recently come into extensive use in connection with electrical machinery, and last year 240 tons of it were mined in Ontario.

PETROLEUM, NATURAL GAS AND PEAT.

VII. Materials of a mineral character used in the production of light and heat are not of first-class importance in Ontario, being limited to petroleum, natural gas, lignite and peat. They are all of organic origin; the two former derived from animal or vegetable fossils, and the two latter from vegetable only. Our petroleum area at one time extended over portions of Lambton and Kent, but the producing field is now wholly confined to a few thousand acres in Lambton. It is obtained from the Corniferous limestone, but the original source may have been in lower formations. Natural gas is a recent discovery, but reservoirs of good producing capacity have been struck by borings in the Counties of Essex, Haldimand and Welland. In Essex the gas rises, it is supposed, from the Clinton formation, whereas in the two eastern counties it rises from the Medina sandstone. Extensive beds of lignite have been discovered interbedded with the drift in the basin of the Moose river and its tributaries, the Abittibi and the Missinaibi. But the peat deposits of the Hudson Bay slope have a vastly greater area, and when the time comes, as doubtless it will come, that peat can be converted into good fuel at an economic price, a material of first-class necessity will be obtainable for the people of Ontario in limitless quantity. Nor, when that time comes, will we be dependent on the peat bogs of the Moose river basin alone. There is hardly a county in the province which does not possess a supply; there are large beds between the Ottawa and St. Lawrence rivers; our lake country is full of it; and along the line of the Canadian Pacific Railway from the Ottawa river to Lake of the Woods there is more of it than would replace the coal fields of Pennsylvania. And it is with some confidence I express the belief that in a process which I had an opportunity of looking into a few days ago the problem of the conversion of peat into fuel has already been solved, in a simple, practical and economic way.

So I come to the end. The subject is very far from being exhausted, but I know that I must have wearied your patience if I have not exhausted your forbearance. Let me, however, express the hope that something has been said which may serve to arouse in your minds a higher opinion of this great Ontario of ours—the first commonwealth of America in the extent and variety of its resources, in the commanding opportunity of its situation, in the excellence of its institutions and the sterling qualities of its men. If I was to give a word of counsel concerning your relations to this commonwealth, the duty you owe to it and the sphere you should aspire to occupy in it when you also become men, it would be only in the words of the Spartan mother when her son was bidding farewell on going out to meet the enemy of his country and might not evermore return:

"SPARTA IS YOUR PORTION," she said; "DO YOUR BEST FOR SPARTA!"

Lubricating Qualities of Graphite—A correspondent to the *American Machinist* says:—"If engineers, machinists, and millwrights in general, and pipe fitters in particular, knew of the good qualities of graphite, I dare say there would be ten times the demand for it. Its primary object is lubrication, and it is to this fact we must credit good pipe joints and cool bearings. In making pipe cement (or as I would term it, pipe smear), it is not necessary to use the best oil or grease, as it is the graphite, and not the body in which it is suspended, that makes the mixture valuable and the joint perfect. I use the drippings from the line shaft bearings caught in the ordinary way, and mix it with the best Ticonderoga flake graphite, so that it can be applied with an ordinary sash tool. During the past three years I have used about 15 lb. or 20 lb. of graphite for pipe joints, cylinder heads, piston and rod packing &c. Bolts smeared with graphite mixed as above, I have unscrewed after having been in the dampest place for upwards of two years or more proving the antirusting qualities of graphite. To cool hot bearings, put it on as thick as it will mix with oil. Almost any oil or grease will answer; but don't use poor graphite."

"Hutton's Theory of the Earth."

[Presidential Address by Prof. Sir Archibald Geikie, at the Edinburgh Meeting of the British Association, 3rd August, 1892.]

Sir Archibald Geikie, who was received with loud applause on rising, said: In its beneficent progress through these islands the British Association for the Advancement of Science now for the fourth time receives a welcome in this ancient capital. Once more, under the shadow of these antique towers, crowded memories of a romantic past fill our thoughts. The stormy annals of Scotland seem to move in procession before our eyes as we walk these streets, whose names and traditions have been made familiar to the civilized world by the genius of literature. At every turn, too, we are reminded, by the monuments which a grateful city has erected, that for many generations the pursuits which we are now assembled to foster have had here their congenial home. Literature, philosophy, science, have each in turn been guided by the influence of the great masters who have lived here, and whose renown is the brightest gem in the chaplet around the brow of this "Queen of the North." Lingering for a moment over these local associations, we shall find a peculiar appropriateness in the time of this renewed visit of the Association to Edinburgh. A hundred years ago a remarkable group of men were discussing here the great problem of the history of the earth. James Hutton, after many years of travel and reflection, had communicated to the Royal Society of this city, in the year 1785, the first outlines of his famous "Theory of the Earth." Among those with whom he took counsel in the elaboration of his doctrines were Black, the illustrious discoverer of "fixed air" and "latent heat;" Clerk, the sagacious inventor of the system of breaking the enemy's line in naval tactics; Hall, whose fertile ingenuity devised the first system of experiments in illustration of the structure and origin of rocks; and Playfair, through whose sympathetic euthusiasm and literary skill Hutton's views came ultimately to be understood and appreciated by the world at large. With these friends, so well able to comprehend and criticise his efforts to pierce the veil that shrouded the history of this globe, he paced the streets amid which we are now gathered together; with them he sought the crags and ravines around us, wherein Nature has laid open so many impressive records of her past; with them he sallied forth on those memorable expeditions to distant parts of Scotland, whence he returned laden with treasures from a field of observation which, though now so familiar, was then almost untrodden. The centenary of Hutton's "Theory of the Earth" is an event in the annals of science which seems most fittingly celebrated by a meeting of the British Association in Edinburgh. In choosing from among the many subjects which might properly engage your attention on the present occasion, I have thought that it would not be inappropriate nor uninteresting to consider the more salient features of that "Theory," and to mark how much in certain departments of inquiry has sprung from the fruitful teaching of its author and his associates. It was a fundamental doctrine of Hutton and his school that this globe has not always worn the aspect which it bears at present; that, on the contrary, proofs may everywhere be culled that the land which we now see has been formed out of the wreck of an older land. Among these proofs, the most obvious are supplied by some of the more familiar kinds of rock, which teach us that, though they are now portions of the dry land, they were originally sheets of gravel, sand and mud, which had been worn from the face of long-vanished continents, and after being spread out over the floor of the sea were consolidated into compact stone, and were finally broken up and raised once more to form part of the dry land. This cycle of change involved two great systems of natural processes. On the one hand, men were taught that by the action of running water the materials of the solid land are in a state of continual decay and transport to the ocean. On the other hand, the ocean floor is liable from time to time to be upheaved by some stupendous internal force akin to that which gives rise to the volcano and the earthquake. Hutton further perceived that not only had the consolidated materials been disrupted and elevated, but that masses of molten rock had been thrust upward among them, and had cooled and crystallized in large bodies of granite and other eruptive rocks which form so prominent a feature on the earth's surface. It was a special characteristic of this philosophical system that it sought in the changes now in progress on the earth's surface an explanation of those which occurred in older times. Its founder refused to invent causes or modes of operation, for those with which he was familiar seemed to him adequate to solve the problems with which he attempted to deal. Nowhere was the profoundness of his insight more astonishing than in the clear definite way in which he proclaimed and reiterated his doctrine, that every part of the surface of the continents, from mountain-top to sea-shore, is continually undergoing decay, and is thus slowly travelling to the sea. He saw that no sooner will the sea floor be elevated into new land than it must necessarily become a prey to this universal and unceasing degradation. He perceived that, as the transport of disintegrated material is carried on chiefly by running water, rivers must slowly dig out for themselves the channels in which they flow, and thus that a system of valleys, radiating from the water-parting of a country, must necessarily result from the descent of the streams from the mountain crests to the sea. He discerned that this ceaseless and widespread decay would eventually lead to the entire demolition of dry land, but he contended that from time to time this catastrophe is prevented by the operation of the underground forces, whereby new continents are upheaved from the bed of the ocean. And thus in his system a due proportion is maintained between land and water, and the condition of the earth as a habitable globe is preserved. A theory of the earth so simple in outline, so bold in conception, so full of suggestion, and resting on so broad a base of observation and reflection, ought, we might think, to have commanded at once the attention of men of science, even if it did not immediately awaken the interest of the outside world; but, as Playfair sorrowfully admitted, it attracted notice only very slowly, and several years elapsed before anyone showed himself publicly concerned about it, either as an enemy or as a friend. Some of its earliest critics assailed it for what they asserted to be its irreligious tendency—an accusation which Hutton repudiated with much warmth. The sneer levelled by Cowper a few years earlier at all inquiries into the history of the universe was perfectly natural and intelligible from that poet's point of view. There was then a widespread belief that this world came into existence some six thousand years ago, and that any attempt greatly to increase that antiquity was meant as a blow to the

AUTHORITY OF HOLY WRIT.

So far, however, from aiming at the overthrow of orthodox beliefs, Hutton evidently regarded his "Theory" as an important contribution in aid of natural religion. He dwelt with unfeigned pleasure on the multitude of proofs which he was able to accumulate of an orderly design in the operations of nature, decay and renovation being so nicely balanced as to maintain the habitable condition of the planet. But as he refused to admit the predominance of violent action in terrestrial changes, and on the contrary contended for the efficacy of the quiet, continuous processes which we can even now see at work around us, he was constrained to require an unlimited duration of past time for the production of those revolutions of which he perceived such clear and abundant proofs in the crust of the earth. The general public, however, failed to comprehend that the doctrine of the high antiquity of the globe was not inconsistent with the comparatively recent appearance of man—a distinction which seems so obvious now. Hutton died in 1797, beloved and regretted by the circle of friends who had learnt to appreciate his estimable character and to admire his genius, but with little recognition from the world at large. Men knew not then that a great master had passed away from their midst, who had laid broad and deep the foundations of a new science; that his name would become a household word in after generations, and that pilgrims would come from distant lands to visit the scenes from which he drew his inspiration. Many years might have elapsed before Hutton's teaching met with wide acceptance, had its recognition depended solely on the writings of the philosopher himself. For, despite his firm grasp of general principles and his mastery of the minutest details, he had acquired a literary style which, it must be admitted, was singularly unattractive. Fortunately for his fame, as well as for the cause of science, his devoted friend and disciple, Playfair, at once set himself to draw up an exposition of Hutton's views. After five years of labour on this task, there appeared the classic "Illustrations of the Huttonian Theory," a work which for luminous treatment and graceful diction stands still without a rival in English geological literature. Though professing merely to set forth his friend's doctrines, Playfair's treatise was in many respects an original contribution to science of the highest value. It placed for the first time in the clearest light the whole philosophy of Hutton regarding the history of the earth, and enforced it with a wealth of reasoning and copiousness of illustration which obtained for it a wide appreciation. From long converse with Hutton, and from profound reflection himself, Playfair gained such a comprehension of the whole subject that, discarding the non-essential parts of his master's teaching, he was able to give so lucid and accurate an exposition of the general scheme of Nature's operations on the surface of the globe, that with only slight corrections and expansions his treatise may serve as a text book to-day. In some respects, indeed, his volume was long in advance of its time. Only, for example, within the present generation has the truth of his teaching in regard to the origin of valleys been generally admitted. Various causes contributed to retard the progress of the Huttonian doctrines. Especially potent was the influence of the teaching of Werner, who, though he perceived that a definite order of sequence could be recognized among the materials of the earth's crust, had formed singularly narrow conceptions of the great processes whereby that crust has been built up. His enthusiasm, however, fired his disciples with the zeal of proselytes, and they spread themselves over Europe to preach everywhere the artificial system which they had learnt in Saxony. By a curious fate Edinburgh became one of the great headquarters of Wernerism. The friends and followers of Hutton found themselves attacked in their own city by zealots who, proud of superior mineralogical acquirements, turned their most cherished ideas upside down and assailed them in

THE UNCOUTH JARGON OF FREIBERG.

Inasmuch as subterranean heat had been invoked by Hutton as a force largely instrumental in consolidating and upheaving the ancient sediments that now form so great a part of the dry land, his followers were nicknamed Plutonists. On the other hand, as the agency of water was almost alone admitted by Werner, who belived the rocks of the earth's crust to have been chiefly chemical precipitates from a primeval universal ocean, those who adopted his views received the equally descriptive name of Neptunists. The battle of these two contending schools raged fiercely here for some years, and though mainly from the youth, zeal, and energy of Jameson, and the influence which his position as Professor in the University gave him, the Wernerian doctrines continued to hold their place, they were eventually abandoned even by Jameson himself, and the debt due to the memory of Hutton and Playfair was tardily acknowledged. The pursuits and the quarrels of philosophers have from early times been a favourite subject of merriment to the outside world. Such a feud as that between the Plutonists and Neptunists would be sure to furnish abundant matter for the gratification of this propensity. Turning over the pages of Kay's "Portraits," where so much that was distinctive of Edinburgh society a hundred years ago is embalmed, we find Hutton's personal peculiarities and pursuits touched off in good-humoured caricature. In one plate he stands with arms folded and hammer in hand, meditating on the face of a cliff, from which rocky prominences, in shape of human faces, perhaps grotesque likenesses of his scientific opponents, grin at him. In another engraving he sits in conclave with his friend Black, possibly arranging for that famous banquet of garden-snails which the two worthies had persuaded themselves to look upon as a strangely neglected form of human food. More than a generation later, when the Huttonists and Wernerists where at the height of their antagonism, the humorous side of the controversy did not escape the notice of the author of "Waverley," who, you will remember when he makes Meg Dods recount the various kinds of wise folk brought by Lady Penelope Pennfeather from Edinburgh to St. Ronan's Well, does not forget to include those who "rin up hill and doon dale, knapping the chucky-stanes to pieces wi hammers, like sae mony road-makers run daft, to see how the warld was made." Among the names of the friends and followers of Hutton there is one which on this occasion deserves to be held in special honour, that of Sir James Hall, of Dunglass. Having accompanied Hutton in some of his excursions, and having discussed with him the problems presented by the rocks of Scotland, Hall was familiar with the views of his master, and was able to supply him with fresh illustrations of them from different parts of the country. Gifted with remarkable originality and ingenuity, he soon perceived that some of the questions involved in the theory of the earth could probably be solved by direct physical experiment. Hutton, however, mistrusted any attempt "to judge of the great operations of Nature by merely kindling a fire and looking into the bottom of a little crucible." Out of deference to this prejudice Hall delayed to carry out his intention during Hutton's lifetime. But afterwards he instituted a remarkable series of researches which are memorable in the history of science as the first methodical endeavour to test the value of geological speculation by an appeal to actual experiment. The Neptunists, in ridiculing the Huttonian doctrine that basalt and similar rocks had once been molten, asserted that, had such been their origin, these masses would now be found in the condition of glass or slag. Hall, however, triumphantly vindicated his friend's view, by proving that basalt could be fused, and thereafter by slow cooling could be made to resume a stony texture. Again, Hutton had asserted that under the vast pressures which must be effective deep within the earth's crust, chemical reactions must be powerfully influenced, and that under such conditions even limestone may conceivably be melted without losing its carbonic acid. Various specious arguments had been adduced against this proposition, but by an ingeniously devised series of experiments Hall succeeded in converting limestones under great pressure into a kind of marble, and even fused it, and found that it then acted vigorously on other rocks. These admirable researches, which laid the foundations of experimental geology, constitute not the least memorable of the services rendered by the Huttonian school to the progress of science. Clear as was the insight and sagacious the inferences of these great masters in regard to the history of the globe, their vision was necessarily limited by the comparatively narrow range of ascertained fact which up to their time had been established. They taught men to recognize that the present world is built of the ruins of an earlier one, and they explained with admirable perspicacity the operation of the processes whereby the degradation and renovation of land are brought about. But they never dreamed that a long and orderly series of such successive destructions and renewals had taken place, and had left their records in the crust of the earth. They never imagined that from these records it would be possible to establish a determinate chronology that could be read everywhere, and applied to the elucidation of the remotest quarter of the globe. It was by the memorable observations and generalizations of William Smith that this vast extension of our knowledge of the past history of the earth became possible. While the Scottish philosophers were building up their theory here, Smith was quietly ascertaining by extended journeys, that the stratified rocks of the West of England occur in a definite sequence, and that each well-marked group of them can be discriminated from the others and identified across the country by means of its enclosed organic remains. It is nearly a hundred years since he made known his views, so that by a curious co-incidence we may fitly celebrate on this occasion the centenary of William Smith as well as that of James Hutton. No single discovery has ever had a more momentous and far-reaching influence on the progress of a science than that law of organic succession which Smith established. At first it served merely to determine the order of the stratified rocks of England. But it soon proved to possess a world-

wide value, for it was found to furnish the key to the structure of the

WHOLE STRATIFIED CRUST

of the earth. It showed that within that crust lie the chronicles of a long history of plant and animal life upon this planet, it supplied the means of arranging the materials for this history in true chronological sequence, and it thus opened out a magnificent vista through a vast series of ages, each marked by its own distinctive types of organic life, which, in proportion to their antiquity, departed more and more from the aspect of the living world. Thus a hundred years ago, by the brilliant theory of Hutton and the fruitful generalization of Smith, the study of the earth received in our country the impetus which has given birth to the modern science of geology. To review the marvellous progress which this science has made during the first century of its existence would require not one but many hours for adequate treatment. The march of discovery has advanced along a multitude of different paths, and the domains of Nature which have been included within the growing territories of human knowledge have been many and ample. Nevertheless, there are certain departments of investigation to which we may profitably restrict our attention on the present occasion, and wherein we may see how the leading principles that were proclaimed in this city a hundred years ago have germinated and borne fruit all over the world. From the earliest times the natural features of the earth's surface have arrested the attention of mankind. The rugged mountain, the cleft ravine, the scarped cliff, the solitary boulder, have stimulated curiosity and prompted many a speculation as to their origin. The shells embedded by millions in the solid rocks of hills far removed from the sea have still further pressed home these "obstinate questionings." But for many long centuries the advance of enquiry into such matters was arrested by the paramount influence of orthodox theology. It was not merely that the Church opposed itself to the simple and obvious interpretation of these natural phenomena. So implicit had faith become in the accepted views of the earth's age and of the history of creation, that even laymen of intelligence and learning set themselves unbidden and in perfect good faith to explain away the difficulties which Nature so persistently raised up, and to reconcile her teachings with those of the theologians. In the various theories thus originating, the amount of knowledge of natural law usually stood in inverse ratio to the share played in them by an uncontrolled imagination. The speculations, for example, of Burnet, Whiston, Whitehurst, and others in this country, cannot be read now without a smile. In no sense were they scientific researches ; they can only be looked upon as exercitations of learned ignorance. Springing mainly out of a laudable desire to promote what was believed to be the cause of true religion, they helped to retard inquiry, and exercised in that respect a baneful influence on intellectual progress. It is the special glory of the Edinburgh School of Geology to have cast aside all this fanciful trifling. Hutton boldly proclaimed that it was no part of his philosophy to account for the beginning of things. His concern lay only with the evidence furnished by the earth itself as to its origin. With the intuition of true genius he early perceived that the only solid basis from which to explore what has taken place in bygone time is a knowledge of what is taking place to-day. He thus founded his system upon a careful study of the processes whereby geological changes are now brought about. He felt assured that Nature must be consistent and uniform in her working, and that only in proportion as her operations at the present time are watched and understood will the ancient history of the earth become intelligible. Thus, in his hands, the investigation of the present became the key to the interpretation of the past. The establishment of this great truth was the first step towards the inauguration of a true science of the earth. The doctrine of the

UNIFORMITY OF CAUSATION IN NATURE

became the fruitful principle on which the structure of modern geology could be built up. Fresh life was now breathed into the study of the earth. A new spirit seemed to animate the advance along every pathway of inquiry. Facts that had long been familiar came to possess a wider and deeper meaning when their connection with each other was recognized as parts of one great harmonious system of continuous change. In no department of nature, for example, was this broader vision more remarkably displayed than in that wherein the circulation of water between land and sea plays the most conspicuous part. From the earliest times men had watched the coming of clouds, the fall of rain, the flow of rivers, and had recognised that on this nicely adjusted machinery the beauty and fertility of the land depends. But they now learnt that this beauty and fertility involve a continual decay of the terrestrial surface ; that the soil is a measure of this decay, and would cease to afford us maintenance were it not continually removed and renewed ; that through the ceasless transport of soil by rivers to the sea the face of the land is slowly lowered in level and carved into mountain and valley, and that the materials thus borne outwards to the floor of the ocean are not lost, but accumulate there to form rocks, which in the end will be upraised into new lands. Decay and renovation, in well-balanced proportions, were thus shown to be the system on which the existence of the earth as a habitable globe had been established. It was impossible to conceive that the economy of the planet could be maintained on any other basis. Without the circulation of water the life of plants and animals would be impossible, and with that circulation the decay of the surface of the land and the renovation of its disintegrated materials are necessarily involved. As it is now so must it have been in past time. Hutton and Playfair pointed to the stratified rocks of the earth's crust as demonstrations that the same processes which are at work to-day have been in operation from a remote antiquity. By thus placing their theory on a basis of actual observation, and providing in the study of existing operations a guide to the interpretation of those in past times, they rescued the investigation of the history of the earth from the speculations of theologians and cosmologists, and established a place for it among the recognised inductive sciences. To the guiding influence or their philosophical system, the prodigious strides made by modern geology are in large measure to be attributed. And here in our own city, after the lapse of a hundred years, let us offer to their memory the grateful homage of all who have profited by their labours. But while we recognise with admiration the far-reaching influence of the doctrine of uniformity of causation in the investigation of the history of the earth, we must upon reflection admit that the doctrine has been pushed to an extreme perhaps not contemplated by its original founders. To take the existing conditions of nature as a platform of actual knowledge from which to start in an inquiry into former conditions was logical and prudent. Obviously, however, human experience, in the few centuries during which attention has been turned to such subjects, has been too brief to warrant any dogmatic assumption that the various natural processes must have been carried on in the past with the same energy and at the same rate as they are carried on now. Variations in energy might have been legitimately conceded as possible, though not to be allowed without reasonable proof in their favour. It was right to refuse to admit the operation of speculative causes of change when the phenomena were capable of natural and adequate explanation by reference to causes that can be watched and investigated. But it was an error to take for granted that no other kind of process or influence, nor any variation in the rate of activity save those of which man has had actual cognisance, has played a part in the terrestrial economy. The uniformitarian writers laid themselves open to the charge of maintaining a kind of perpetual motion in the machinery of nature.

They could find in the records of the earth's history no evidence of a beginning, no prospect of an end. They saw that many successive renovations and destructions had been effected on the earth's surface, and that this long line of vicissitudes formed a series of which the earliest were lost in antiquity, while the latest were still in progress towards an apparently illimitable future. The discoveries of William Smith, had they been adequately understood, would have been seen to offer a corrective to this rigidly uniformitarian conception, for they revealed that the crust of the earth contains the long record of an unmistakable order of progression in organic types. They proved that plants and animals have varied widely in successive periods of the earth's history, the present condition of organic life being only the latest phase of a long preceding series, each stage of which recedes further from the existing aspect of things as we trace it backward into the past. and though no relic had yet been found, or indeed was ever likely to be found, of the first living things that appeared upon the earth's surface, the manifest simplification of types in the older formations pointed irresistibly to some beginning from which the long procession has taken its start. If then it could thus be demonstrated that there had been upon the globe an orderly march of living forms from the lowliest grades in earily times to man himself to-day, and thus that in one department of her domain, extending through the greater portion of the records of the earths's history, Nature had not been uniform but had followed a vast and noble plan of evolution, surely it might have been expected that those who discovered and made known this plan would seek to ascertain whether some analogous physical progression from a definite beginning might not be discernible in the framework of the globe itself. But the early masters of the science laboured under two great disadvantages. In the first place, they found the oldest records of the earth's history so broken up and effaced as to be no longer legible. And in the second place, they lived under the spell of that strong reaction against speculation which followed the bitter controversy between the Neptunists and Plutonists in the earlier decades of the century. They considered themselves bound to search for facts, not to build up theories ; and as in the crust of the earth they could find no facts which threw any light upon the primeval constitution and subsequent development of our planet, they shut their ears to any theoretical interpretations that might be offered from other departments of science. It was enough for them to maintain, as Hutton had done, that in the visible structure of the earth itself no trace can be found of the beginning of things, and that the oldest terrestrial records reveal no physical conditions essentially different from those in which we still live. They doubtless listened with interest to the speculations of Kant, Laplace, and Herschel, on the probable evolution of nebulae, suns, and planets, but it was with the languid interest attaching to ideas that lay outside of their own domain of research. They recognised no practical connection between such speculations and the data furnished by the earth itself as to its own history and progress. This curious lethargy with respect to theory on the part of men who were popularly regarded as among the most speculative followers of science would probably not have been speedily dispelled by any discovery made within their own field of observation. Even now, after many years of the most diligent research, the first chapters of our planet's history remain undiscovered or undecipherable. On the great terrestrial palimpsest the earliest inscriptions seem to have been hopelessly effaced by those of later ages. But the question of the primeval condition and subsequent history of the planet might be considered from the side of astronomy and physics. And it was by investigations of this nature that the geological torpor was eventually dissipated. To our illustrious former President, Lord Kelvin, who occupied this chair when the Association last met in Edinburgh, is mainly due the rousing of attention to this subject. By the most convincing arguments he showed how impossible it was to believe in the extreme doctrine of uniformitarianism. And though, owing to uncertainty in regard to some of the data, wide limits of time were postulated by him, he insisted that within these limits the whole evolution of the earth and its inhabitants must have been comprised. While, therefore, the geological doctrine that the present order of nature must be our guide to the interpretation of the past remained as true and fruitful as ever, it had now to be widened by the reception of evidence furnished by a study of the earth as a planetary body. The secular loss of heat, which demonstrably takes place both from the earth and the sun, made it quite certain that the present could not have been the original condition of the system. This diminution of temperature with all its consequences is not a mere matter of speculation, hut a physical fact of the present time as much as any of the familiar physical agencies that affect the surface of the globe. It points with unmistakable directness to that beginning of things of which Hutton and his followers could find no sign. Another modification or enlargement of the uniformitarian doctrine was brought about by continued investigation of the terrestrial crust and consequent increase of knowledge respecting the history of the earth. Though Hutton and Playfair believed in periodical catastrophes, and indeed required these to recur in order to renew and preserve the habitable condition of our planet, their successors gradually came to view with repugnance any appeal to abnormal, and especially to violent manifestations of terrestrial vigour, and even persuaded themselves that such slow and comparatively feeble action as had been witnessed by man could alone be recognised in the evidence from which geological history must be compiled. Well do I remember in my own boyhood what a cardinal article of faith this prepossession had become. We were taught by our great and honoured master, Lyell, to believe implicitly in gentle and uniform operations, extending over indefinite periods of time, though possibly some, with the zeal of partisans, carried this belief to an extreme which Lyell himself did not approve. The most stupendous marks of terrestrial disturbance, such as the structure of great mountain chains, were deemed to be more satisfactorily accounted for by slow movements prolonged through indefinite ages than by any sudden convulsion. What the more extreme members of the uniformitarian school failed to perceive was the absence of all evidence that terrestrial catastrophes even on a collossal scale might not be a part of the present economy of this globe. Such occurrences might never seriously affect the whole earth at one time, and might return at such wide intervals that no example of them has yet been chronicled by man. But that they have occurred again and again, and even within comparatively recent geological times, hardly admits of serious doubt How far at different epochs and in various degrees they may have included the operation of cosmical influences lying wholly outside the planet, and how far they have resulted from movements within the body of the planet itself, must remain for further inquiry. Yet the admission that they have played a part in geological history may be freely made without impairing the real value of the Huttonian doctrine, that in the interpretation of this history our main guide must be a knowledge of the existing processes of terrestrial change. As the most recent and best known of these great transformations, the Ice Age stands out conspicuously before us. If any one sixty years ago had ventured to affirm that at no very distant date the snows and glaciers of the Arctic regions stretched southwards into France, he would have been treated as a mere visionary theorist. Many of the facts to which he would have appealed in support of his statement were already well known, but they had received various other interpretations. By some observers, notably by Hutton's friend, Sir James Hall, they were believed to be due to violent debacles of water that swept over the face of the land. By others they were attributed to the strong tides and currents of the sea when the land stood at a lower level. The uniformitarian school of Lyell had no difficulty in elevating or depressing land to any required extent. Indeed, when we consider how averse these philosophers were to admit any degree of natural operation others than those of which there was some human experience, we may well wonder at the boldness with which, on sometimes the slenderest evidence, they made land and sea change places, on the one hand submerging mountain-ranges, and on the other placing great barriers of land where a deep ocean rolls. They took such liberties with geography because only well-established processes of change were invoked in the operations. Knowing that during the passage of an earthquake a territory bordering the sea may be upraised or sunk a few feet, they drew the sweeping inference that any amount of upheaval or depression of any part of the earth's surface might be claimed in explanation of geological problems. The progress of inquiry, while it has somewhat curtailed this geographical license, has now made known in great detail the strange story of the Ice Age. There cannot be any doubt that after man had become a denizen of the earth, a great physical change came over the northern hemisphere. The climate, which had previously been so mild that evergreen trees flourished within ten or twelve degrees of the north pole, now became so severe

that vast sheets of snow and ice covered the north of Europe and crept southward beyond the south coast of Ireland, almost as far as the southern shores of England, and across the Baltic into France and Germany. This Arctic transformation was not an episode that lasted merely a few seasons, and left the land to resume thereafter its ancient aspect. With various successive fluctuations it must have endured for many thousands of years. When it began to disappear it probably faded away as slowly and imperceptibly as it had advanced, and when it finally vanished it left Europe and North America profoundly changed in the character alike of their scenery and of their inhabitants. The rugged rocky contours of earlier times were ground smooth and polished by the march of the ice across them, while the lower grounds were buried under wide and thick sheets of clay, gravel and sand, left behind by the melting ice. The varied and abundant flora which had spread so far within the Arctic circle was driven away into more southern and less ungenial climes. But most memorable of all was the extirpation of the prominent large animals which, before the advent of the ice, had roamed over Europe. The lions, hyænas, wild horses, hippopotami and other creatures either became entirely extinct or were driven into the Mediterranean basin and into Africa. In their places came northern forms—the reindeer, glutton, musk ox, woolly rhinoceros, and mammoth. Such a marvellous tranformation in climate, in scenery, in vegetation and in inhabitants, within what was after all but a brief portion of geological time, though it may have involved no sudden or violent convulsion, is surely entitled to rank as a catastrophe in the history of the globe. It was probably brought about mainly if not entirely by the operation of forces external to the earth. No similar calamity having befallen the continents within the time during which man has been recording his experience, the Ice Age might be cited as a contradiction to the doctrine of uniformity. And yet it manifestly arrived as part of the established order of Nature. Whether or not we grant that other Ice Ages preceded the last great one, we must admit that the conditions under which it arose, so far as we know them, might conceivably have occured before and may occur again. The various agencies called into play by the extensive refrigeration of the northern hemisphere were not different from those with which we are familiar. Snow fell and glaciers crept as they do to-day. Ice scored and polished rocks exactly as it still does among the Alps and in Norway. There was nothing abnormal in the phenomena save the scale on which they were manifested. And thus, taking a broad view of the whole subject, we recognise the catastrophe, while at the same time we see in its progress the operation of those same natural processes which we know to be integral parts of the machinery whereby the surface of the earth is continually transformed. Among the debts which science owes to the Huttonian school, not the least memorable is the promulgation of the first well-founded conceptions of the high antiquity of the globe. Some six thousand years had previously been believed to comprise the whole life of the planet, and indeed of the entire universe. When the curtain was then first raised that had veiled the history of the earth, and men, looking beyond the brief space within which they had supposed that history to have been transacted, beheld the records of a long vista of ages stretching far away into a dim illimitable past, the prospect vividly impressed their imagination. Astronomy had made known the immeasurable fields of space; the new science of geology seemed now to reveal boundless distances of time. The more the terrestrial chronicles were studied the farther could the eye range into an antiquity so vast as to defy all attempts to measure or define it. The progress of research continually furnished additional evidence of the enormous duration of the ages that preceded the coming of man, while, as knowledge increased, periods that were thought to have followed each other consecutively were found to have been separated by prolonged intervals of time. Thus the idea arose and gained universal acceptance that, just as no boundary could be set to the astronomer in his free range through space, so the whole of bygone eternity lay open to the requirements of the geologist. Playfair, re-echoing and expanding Hutton's language, had declared that neither among the records of the earth nor in the planetary motions can any trace be discovered of the beginning or of the end of the present order of things; that no symptom of infancy or of old age has been allowed to appear on the face of Nature, nor any sign by which either the past or the future duration of the universe can be estimated; and that although the Creator may put an end as He no doubt gave a beginning, to the present system, such a catastrophe will not be brought about by any of the laws now existing, and is not indicated by anything which we perceive. This doctrine was naturally espoused with warmth by the extreme uniformitarian school, which required an unlimited duration of time for the accomplishment of such slow and quiet cycles of change as they conceived to be alone recognizable in the records of the earth's past history. It was Lord Kelvin who, in the writings to which I have already referred, first called attention to the fundamentally erroneous nature of these conceptions. He pointed out that from the high internal temperature of our globe, increasing inwards as it does, and from the rate of loss of its heat, a limit may be fixed to the planet's antiquity. He showed that so far from there being no sign of a beginning, and no prospect of an end to the present economy, every lineament of the solar system bears witness to a gradual dissipation of energy from some definite starting point. No very precise data were then, or indeed are now, available for computing the interval which has elapsed since that remote commencement, but he estimated that the surface of the globe could not have consolidated less than twenty millions of years ago, for the rate of increase of temperature inwards would in that case have been higher than it actually is; nor more than 400 millions of years ago, for then there would have been no sensible increase at all. He was inclined, when first dealing with the subject, to believe that from a review of all the evidence then available some such period as

100 MILLIONS OF YEARS AGO

would embrace the whole geological history of the globe. It is not a pleasant experience to discover that a fortune which one has unconcernedly believed to be ample has somehow taken to itself wings and disappeared. When the geologist was suddenly awakened by the energetic warning of the physicist, who assured him that he had enormously overdrawn his accounnt with past time, it was but natural under the circumstances that he should think the accountant to be mistaken, who thus returned to him dishonoured the large drafts he had made on eternity. He saw how wide were the limits of time deducible from physical considerations, how vague the data from which they had been calculated. And though he could not help admitting that a limit must be fixed beyond which his chronology could not be extended, he consoled himself with the reflection that after all a hundred millions of years was a tolerably ample period of time, and might possibly have been quite sufficient for the transaction of all the prolonged sequence of events recorded in the crust of the earth. He was therefore disposed to acquiesce in the limitation thus imposed upon geological history. But physical inquiry continued to be pushed forward with regard to the early history and the antiquity of the earth. Further consideration of the influence of tidal friction in retarding the earth's rotation, and of the sun's rate of cooling, led to sweeping reductions of the time allowable for the evolution of the planet. The geologist found himself in the plight of Lear when his bodyguard of one hundred knights was cut down. "What need you five and twenty, ten or five?" demands the inexorable physicist, as he remorselessly strikes slice after slice from his allowance of geological time. Lord Kelvin is willing, I believe to grant us some twenty millions of years, but Professor Tait would have us content with less than ten millions. In scientific as in other mundane questions there may often be two sides, and the truth may ultimately be found not to lie wholly with either. I frankly confess that the demands of the early geologists for an unlimited series of ages were extravagant, and even, for their own purposes, unnecessary, and that the physicist did good service in reducing them. It may also be freely admitted that the latest conclusions from physical considerations of the extent of geological time require that the interpretation given to the record of the rocks should be rigorously revised, with the view of ascertaining how far that interpretation may be capable of modification or amendment. But we must also remember that the geological record constitutes a voluminous body of evidence regarding the earth's history which cannot be ignored, and must be explained in accordance with ascertained natural laws. If the conclusions derived from the most careful study of this record cannot be reconciled with those drawn from physical considerations, it is surely not too much to ask that the latter should be also revised. It has been well said that the mathematical mill is an admirable piece of machinery, but that the value of what it yields depends upon the quality of what is put into it. That there must be some flaw in the physical argument I can, for my own part hardly doubt, though I do not pretend to be able to say where it is to be found. Some assumption, it seems to me, has been made, or some consideration has been left out of sight, which will eventually be seen to vitiate the conclusions, and which when duly taken into account will allow time enough for any reasonable interpretation of the geological record. In problems of this nature, where geological data capable of numerical statements are so needful, it is hardly possible to obtain trustworthy computations of time. We can only measure the rate of changes in progress now, and infer from these changes the length of time required for the completion of results achieved by the same processes in the past. There is fortunately one great cycle of movement which admits of careful investigation, and which has been made to furnish valuable materials for estimates of this kind. The universal degradation of the land, so notable a characteristic of the earth's surface, has been regarded as an extremely slow process. Though it goes on without ceasing, yet from century to century it seems to leave hardly any perceptible trace on the landscapes of a country. Mountains and plains, hills and valleys, appear to wear the same familiar aspect which is indicated in the oldest pages of history. This obvious slowness in one of the most important departments of geological activity, doubtless contributed in large measure to form and foster a vague belief in the vastness of the antiquity required for the evolution of the earth. But, as geologists eventually came to perceive, the rate of degradation of the land is capable of actual measurement. The amount of material worn away from the surface of any drainage-basin and carried in the form of mud, sand, or gravel, by the main river into the sea, represents the extent to which that surface has been lowered by waste in any given period of time. But denudation and deposition must be equivalent to each other. As much material must be laid down in sedimentary accumulations as has been mechanically removed, so that in measuring the annual bulk of sediment borne into the sea by a river, we obtain a clue not only to the rate of denudation of the land, but also to the rate at which the deposition of new sedimentary formations takes place. As might be expected, the activities involved in the lowering of the surface of the land are not everywhere equally energetic. They are naturally more vigorous where the rainfall is heavy, where the daily range of temperature is large and where frosts are severe. Hence they are obviously much more effective in mountainous regions than on plains; and their results must constantly vary, not only in different basins of drainage, but even, and sometimes widely, within the same basin. Actual measurement of the proportions of sediment in river water shows that while in some cases the lowering of the surface of the land may be as much as 1-730 of a foot in a year, in others it falls as low as 1-6800. In other words, the rate of

DEPOSITION OF NEW SEDIMENTARY FORMATIONS,

over an area of sea-floor equivalent to that which has yielded the sediment, may vary from one foot in 730 years to one foot in 6800 years. If now we take these results and apply them as measures of the length of time required for the deposition of the various sedimentary masses that form the outer part of the earth's crust, we obtain some indication of the duration of geological history. On a reasonable computation these stratified masses, where most fully developed, attain a united thickness of not less than 100,000 feet. If they were all laid down at the most rapid recorded rate of denudation, they would require a period of seventy-three millions of years for their completion. If they were laid down at the slowest rate they would demand a period of not less than 680 millions. But it may be argued that all kinds of terrestrial energy are growing feeble, that the most active denudation now in progress is much less vigorous than that of bygone ages, and hence that the stratified part of the earth's crust may have been put together in a much briefer space of time than modern events might lead us to suppose. Such arguments are easily adduced and look sufficiently specious, but no confirmation of them can be gathered from the rocks. On the contrary, no one can thoughtfully study the various systems of stratified formations without being impressed by the fulness of their evidence that, on the whole, the accumulation of sediment has been extremely slow. Again and again we encounter groups of strata composed of thin paper-like laminæ of the finest silt, which evidently settled down quietly and at intervals on the sea bottom. We find successive layers covered with ripple-marks and sun-cracks, and we recognize in them memorials of ancient shores where sand and mud tranquilly gathered as they do in sheltered estuaries at the present day. We can see no proof whatever, nor even any evidence which suggests, that on the whole the rate of waste and sedimentation was more rapid during Mesozoic and Palaeozoic time than it is to-day. Had there been any marked difference in this rate from ancient to modern times, it would be incredible that no clear proof of it should have been recorded in the crust of the earth. But in actual fact the testimony in favour of the slow accumulation and high antiquity of the geological record is much stronger than might be inferred from the mere thickness of the stratified formations. These sedimentary deposits have not been laid down in one unbroken sequence, but have had their continuity interrupted again and again by upheaval and depression. So fragmentary are they in some regions, that we can easily demonstrate the length of time represented there by still existing sedimentary strata to be vastly less then the time indicated by the gaps in the series. There is yet a further and impressive body of evidence furnished by the successive races of plants and animals which have lived upon the earth and have left their remains sealed up within its rocky crust. No one now believes in the exploded doctrine that successive creations and universal destructions of organic life are chronicled in the stratified rocks. It is everywhere admitted that, from the romotest times up to the present day, there has been an onward march of development, type succeeding type in one long continuous progression. As to the rate of this evolution precise data are wanting. There is, however, the important negative argument furnished by the absence of evidence of recognisable specific variations of organic forms since man began to observe and record. We know that within experience a few species have become extinct, but there is no conclusive proof that a single new species has come into existence, nor are appreciable variations readily apparent in forms that live in a wild state. The seed and plants found with Egyptian mummies, and the flowers and fruits depicted on Egyptian tombs, are easily indentified with the vegetation of modern Egypt. The embalmed bodies of animals found in that country show no sensible divergence from the structure or proportions of the same animals at the present day. The human races of Northern Africa and Western Asia were already as distinct when portrayed by the ancient Egyptian artists as they are now, and they do not seem to have undergone any perceptible change since then. Thus a lapse of four or five thousand years has not been accompaied by any recognisable variation in such forms of plant and animal life as can be tendered in evidence. Absence of sensible change in these instances is, of course, no proof that considerable alteration may not have been accomplished in other forms more exposed to vicissitudes of climate and other external influences. But it furnishes at least a presumption in favour of the extremely tardy progress of organic variation. If, however, we extend our vision beyond the narrow range of human history, and look at the remains of the plants and animals preserved in those younger formations which, though recent when regarded as parts of the whole geological record, must be many thousands of years older than the very oldest of human monuments, we encounter the most impressive proofs of the persistence of specific forms. Shells which

lived in our seas before the coming of the Ice Age present the very same peculiarities of form, structure, and ornament which their descendants still possess. The lapse of so enormous an interval of time has not sufficed seriously to modify them. So too with the plants and the higher animals which still survive. Some forms have become extinct, but few or none which remain display any transitional gradations into new species. We must admit that such transitions have occurred, that indeed they have been in progress ever since organised existence began upon our planet, and are doubtless taking place now. But we cannot detect them on the way, and we feel constrained to believe that their march must be excessively slow. There is no reason to think that the rate of organic evolution has ever seriously varied; at least no proof has been adduced of such variation. Taken in connection with the testimony of the sedimentary rocks, the inferences deducible from fossils entirely bear out the opinion that the building up of the stratified crust of the earth has been extremely gradual. If the many thousands of years which have elapsed since the Ice Age have produced no appreciable modification of surviving plants and animals, how vast a period must have been required for that marvellous scheme of organic development which is chronicled in the rocks! After careful reflection on the subject, I affirm that the geological record furnishes a mass of evidence which no arguments drawn from other departments of Nature can explain away, and which, it seems to me, cannot be satisfactorily interpreted save with an allowance of time much beyond the narrow limits which recent physical speculation would concede. I have reserved for final consideration a branch of the history of the earth which, while it has become, within the lifetime of the present generation, one of the most interesting and fascinating departments of geological inquiry, owed its first impulse to the far-seeing intellects of Hutton and Playfair. With the penetration of genius these illustrious teachers perceived that if the broad masses of land and the great chains of mountains owe their origin to stupendous movements which from time to time have convulsed the earth, their details of contour must be mainly due to the eroding power of running water. They recognized that as the surface of the land is continually worn down, it is essentially by a process of sculpture that the physiognomy of every country has been developed, valleys being hollowed out and hills left standing, and that these inequalities in topographical detail are only varying and local accidents in the progress of the one great process of the degradation of the land. From the broad and guiding outlines of theory thus sketched we have now advanced amid ever-widening multiplicity of detail into a fuller and nobler conception of the origin of scenery.

THE LAW OF EVOLUTION

is written as legibly on the landscapes of the earth as on any other page of the Book of Nature. Not only do we recognize that the existing topography of the continents, instead of being primeval in origin, has gradually been developed after many precedent mutations, but we are enabled to trace these earlier evolutions in the structure of every hill and glen. Each mountain-chain is thus found to be a memorial of many successive stages in geographical evolution. Within certain limits, land and sea have changed places again and again. Volcanoes have broken out and have become extinct in many countries long before the advent of man. Whole tribes of plants and animals have meanwhile come and gone, and in leaving their remains behind them as monuments at once of the slow development of organic types, and of the prolonged vicissitudes of the terrestrial surface, have furnished materials for a chronological arrangement of the earth's topographical features. Nor is it only from the organisms of former epochs that broad generalizations may be drawn regarding revolutions in geography. The living plants and animals of to-day have been discovered to be eloquent of ancient geographical features that have long since vanished. In their distribution they tell us that climates have changed, that islands have been disjoined from continents, that oceans once united have been divided from each other, or once separate have now been joined; that some tracts of land have disappeared, while others for prolonged periods of time have remained in isolation. The present and the past are thus linked together not merely by dead matter, but by the world of living things, into one vast system of continuous progression. In this marvellous increase of knowledge regarding the transformations of the earth's surface, one of the most impressive features, to my mind, is the power now given to us of perceiving the many striking contrasts between the present and former aspects of topography and scenery. We seem to be endowed with a new sense. What is seen by the bodily eye—mountain, valley, or plain—serves but as a veil, beyond which, as we raise it, visions of long-lost lands and seas rise before us in a far-retreating vista. Pictures of the most diverse and opposite character are beheld, as it were, through each other, their lineaments subtly interwoven and even their most vivid contrasts subdued into one blended harmony. Like the poet, "we see, but not by sight alone," and the "ray of fancy" which, as a sunbeam, lightened up his landscape, is for us broadened and brightened by that play of the imagination which science can so vividly excite and prolong. Admirable illustrations of this modern interpretation of scenery are supplied by the district wherein we are now assembled. On every side of us rise the most convincing proofs of the reality and potency of that ceaseless sculpture by which the elements of landscape have been carved into their present shapes. Turn where we may, our eyes rest on hills that project above the lowland, not because they have been upheaved into these positions, but because their stubborn materials have enabled them better to withstand the degradation which has worn down the softer strata into the plains around them. Inch by inch the surface of the land has been lowered, and each hard rock successively laid bare has communicated its own characteristics of form and colour to the scenery. If, standing on the Castle Rock, the central and oldest site in Edinburgh, we allow the bodily eye to wander over the fair landscape, and the mental vision to range through the long vista of earlier landscapes which science here reveals to us, what a strange series of pictures passes before our gaze! The busy streets of to-day seem to fade away into the mingled copsewood and forest of prehistoric time. Lakes that have long since vanished gleam through the woodlands, and a rude canoe pushing from the shore startles the red deer that had come to drink. While we look the picture changes to a polar scene, with bushes of stunted Arctic willow and birch, among which herds of reindeer browse and the huge mammoth makes his home. Thick sheets of snow are draped all over the hills around, and far to the north-west the distant gleam of glaciers and snowfields marks the line of the Highland mountains. As we muse on this strange contrast to the living world of to-day the scene appears to grow more Arctic in aspect, until every hill is buried under one vast sheet of ice, 2,000 feet or more in thickness, which fills up the whole midland valley of Scotland, and creeps slowly eastward into the basin of the North Sea. Here the curtain drops upon our moving pageant, for in the geological record of this part of the country an enormous gap occurs before the coming of the Ice Age. When once more the spectacle resumes its movement the scene is found to have utterly changed. The familiar hills and valleys of the Lothians have disappeared. Dense jungles of a strange vegetation —tall reeds, club-mosses, and tree ferns—spread over the steaming swamps that stretch for leagues in all directions. Broad lagoons and open seas are dotted with little volcanic cones which throw out their streams of lava and showers of ashes. Beyond these, in dimmer outline and older in date, we descry a wide lake or inland sea, covering the whole midland valley and marked with long lines of active volcanoes, some of them several thousand feet in height. And still further and fainter over the same region, we may catch a glimpse of that still earlier expanse of sea which in Silurian times overspread most of Britain. But beyond this scene our vision fails. We have reached the limit across which no geological evidence exists to lead the imagination into the primeval darkness beyond. Such in briefest outline is the succession of mental pictures which modern science enables us to frame out of the landscapes around Edinburgh. They may be taken as illustrations of what may be drawn, and sometimes with even greater fulness and vividness, from any district in these islands. But I cite them especially because of their local interest in connection with the present meeting of the Association, and because the rocks that yield them gave inspiration to those great masters whose claims on our recollection, not least for their explanation of the origin of scenery, I have tried to recount this evening. But I am further impelled to dwell on these scenes from an overmastering personal feeling to which I trust I may be permitted to give expression. It was these green hills and grey crags that gave me in boyhood the impulse that has furnished the work and joy of my life. To them, amid changes of scene and surroundings, my heart ever fondly turns, and here I desire gratefully to acknowledge that it is to their influence that I am indebted for any claim I may possess to stand in the proud position in which your choice has placed me.

During the delivery of his address, Sir Archibald was frequently applauded, and at the conclusion he was heartily cheered.

CORRESPONDENCE.

Notes from Illecillewaet, B.C.

The Editor:

SIR,—It is quite refreshing to read all the varied incidents that crowd the columns of a weekly newspaper, especially when you yourself are located in one of the bye corners of the world. You feel like one who had drifted into a quiet eddy, whilst the great stream of life went swirling past on its mighty way, and only a dim and distant echo of the many eventful episodes that go to make up the sum of the daily struggle of the teeming, toiling millions of this great continent, floats, as it were, to your ears, or rather eyes. Buried among the mighty mountains of the Selkirks, which tower 5,000 feet on either side into the air, time was, and not many years ago, when as far as reaching the outer world, buried would be the proper description of existence in this locality. Now, thanks to the iron road, we can say with our French neighbours, "Nous avons changé tout cela;" and having access therefore to the outer world, our woes, wants, hopes, fears, prospects, etc., etc., can find a vent through the columns of your valuable paper, and if our small contribution does not interest the readers, at least the effort to rescue ourselves from oblivion has been made.

We are still in existence; that is the main point to bear in mind; and we shall be heard of in a rather surprising manner before long, or the indications are all wrong. Perhaps such a statement needs verification by facts, and such will be forthcoming. The spring of this year opened up with apparently the most cheering prospects, and all looked forward to a great impetus in mining development; perhaps the hopes were too sanguine, or rather unforeseen contingences were not counted on. Progress is the order of the day, but not the feverish, wild, exciting rush that was expected and looked forward to with longing eyes by those who had stood by their prospects for years, and looked forward to a substantial reward for their patience.

No fevered rush has taken place, but a large number of claims have changed hands; in some cases large prices have been given. The best known claims are now held by parties who intend developing them, and as such work is not of the rushing order, and requires time, and intelligent direction of work, there is not apparently much difference in the appearance of things to the outside or superficial observer. Some people seem to run away with an idea that mines can be tested, tramways built, reduction works established, and an army of men put to work in the course of a few weeks, or like the transformation scene of a pantomine, and that paying dividends are become an immediate contingency on the investment of a little capital in a mine—or perhaps a very shadowy prospect. Consequently, so many are ready to decry all kinds of mining investment, because they really know nothing about it. But this is old news, and repeats itself "ad nauseam." This is not our situation. We have the mineral in large quantities, and our mines will bye and bye be one of the features of British Columbia. We have had a fair number of visitors from the outside world wishing to become better acquainted with the value of the mineral deposits. Each and every one has been greatly impressed with what they were shown, and mean returning; at least they say so, and there is some comfort in that for those who are satisfied with the day of small things. Now to speak of tangible progress. The "Maple Leaf" has changed hands for $50,000; the "Dunvagan" for $15,000; the "Blue Bell" for $6,000; the "Goat Cave" for $20,000; and quite a number of other claims from $150 to $1,000. These claims have been bought from the original prospectors by the representatives of real live companies, who mean testing them for all they are worth, so if our progress is not fast, the probabilities point to a sure and steady progression that will be lasting, and by which the resources of the district will be more fully known. A large amount of prospecting is also going quietly on, and a number of new claims are being located. The new Act restricting the number of claims to be held in one district by any individual miner to two by location, has prevented what could have been made quite a monopoly if no limit had been placed on the number of claims held by one miner. The number that can be held by purchase is practically unlimited. Thus the prospector has an excellent opportunity to dispose of his claim or prospect to those wishing to purchase or invest in mining property, if through lack of funds (which is generally the chronic condition of the prospector) he is unable to develop the property himself.

The tramway to the "Lanark" mine has not been commenced yet, though rumour is busy with the statement that it is soon to be an accomplished fact; time will show. At present the mine is shut down for a while. They have a very large amount of ore ready to send down on completion of tramway, and an immense quantity in sight. It is said from pretty good authority that this mine could give an output of $800,000 worth of ore in a short time. The ordinary assessment work has been the order of the day so far, and kept all hands occupied.

At Fish Creek, Messrs. Fishburn and Fowler are steadily working, developing the properties they bought in the spring. They speak hopefully of their prospects. They employ some twelve men constantly and have done so for some months.

Messrs. Ryckman and Scott are busy on the "Elizabeth" at present, sinking a shaft on the lead, and driving a tunnel to tap the lead at about 150 feet below the surface. They are in about 70 feet, and their tunnel, when completed, will be about 160 feet in length. The rock is very kindly to work and they are making most satisfactory progress. They keep three shifts of men going—eight hour shifts—employing about 14 men all told. A tunnel has also been driven some 40 feet on the "Link," but is now shut down for a while. All the claims here have the assessment work done, and they are waiting developments in the other claims now working.

The Elizabeth people expect to strike something very good when they arrive at the lead—and the probabilities are that their expectations will be realized.

Apropos of Fish Creek and the Elizabeth, there is a true story. They had a great quantity of red carbonates, with solid galena while sinking the shaft, and by some means took a notion that the carbonates were worthless and threw them all away down the waste dump. As there was about two feet six in width of carbonates and they had gone down 25 feet, a considerable amount was thrown away; but they saved about two tons of it. No one seemed to think it any good. It was, however, resolved at last to send some to Golden for assay, which was done. Judge of their feelings when the assay return showed the following result: Silver, 701 oz.; gold, traces; lead, 4%; and as they had thrown some five or six tons away, they felt comfortable. *But of such*, etc., etc.

Also *re* Fish Creek: We had a gentleman, accompanied by a friend, who came to explore for soft snaps, recruit health and enjoy sport. They had an excellent outfit; required six horses to carry baggage; they came to Fish Creek and camped. They were not aware that every party in these mountains has, by some unknown and occult understanding, a bear told off to attend them. I expect a sort of courtesy shown by the hierarchy of bears. It is nevertheless true, each party will always have a bear

TRANSACTIONS
OF THE MINING SOCIETY OF NOVA SCOTIA

To Illustrate Mr. John E. Hardman's Paper,

"RECENT GOLD MILLING PRACTICE IN NOVA SCOTIA."

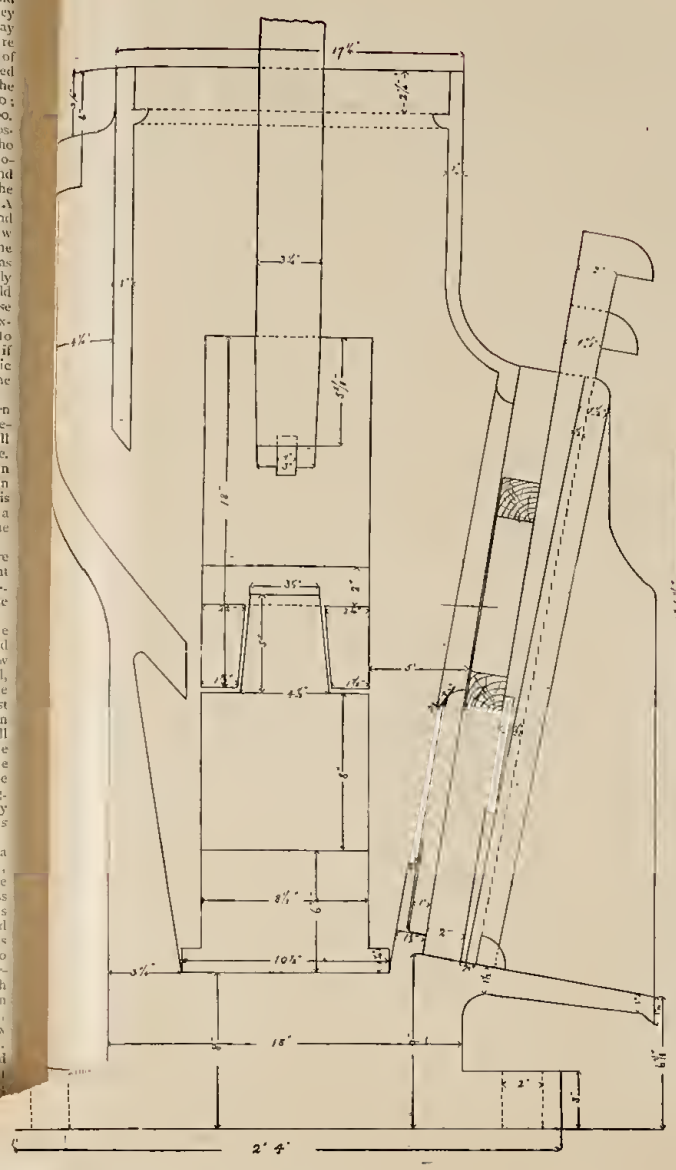


Fig. 1

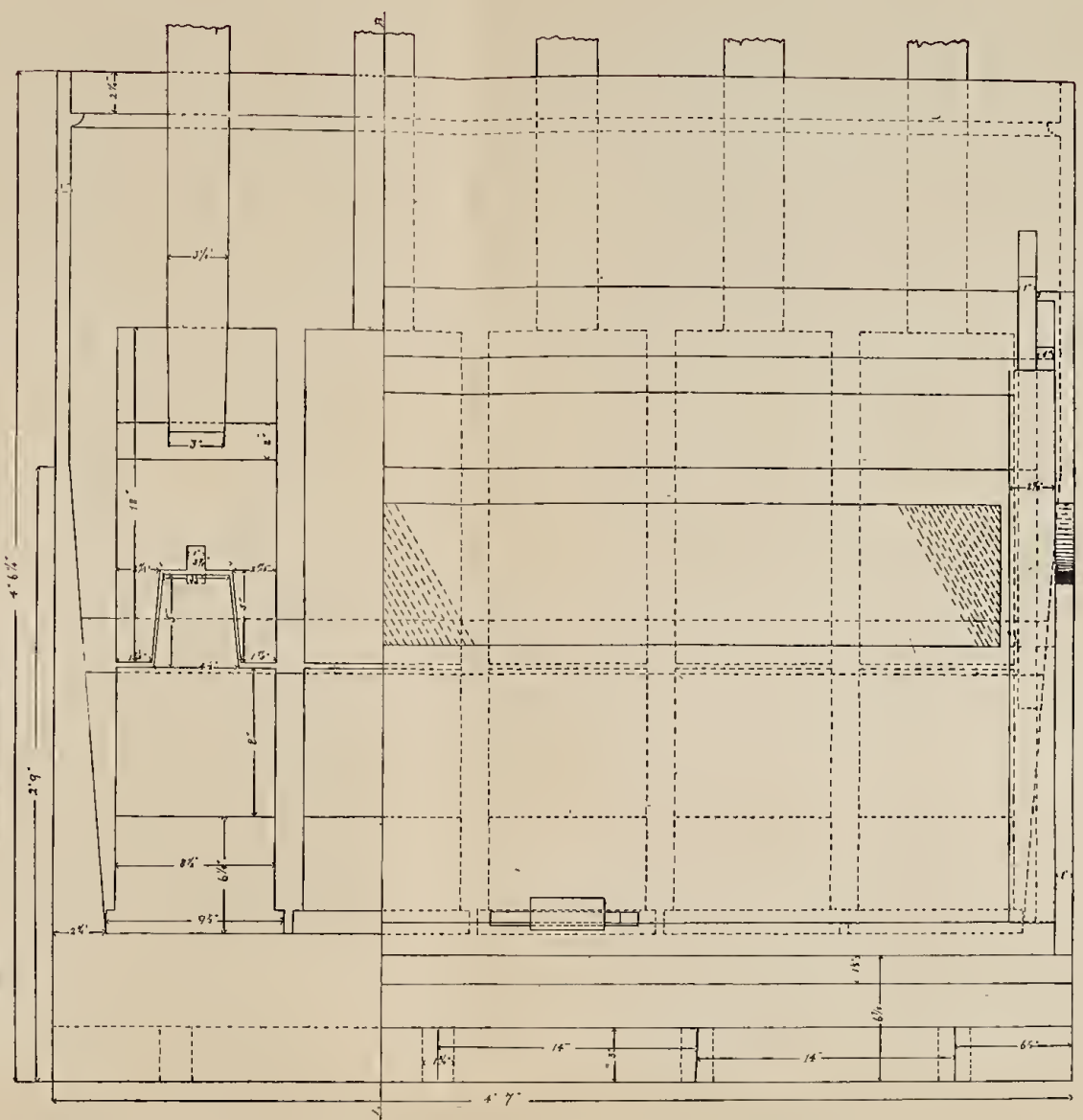


Fig. 2

OLDHAM GOLD MILL

OLDHAM DISTRICT
NOVA SCOTIA
1891.

PLAN AND SECTIONAL ELEVATION
OF
MORTAR.

Scale 3 Inches = 1 Foot.

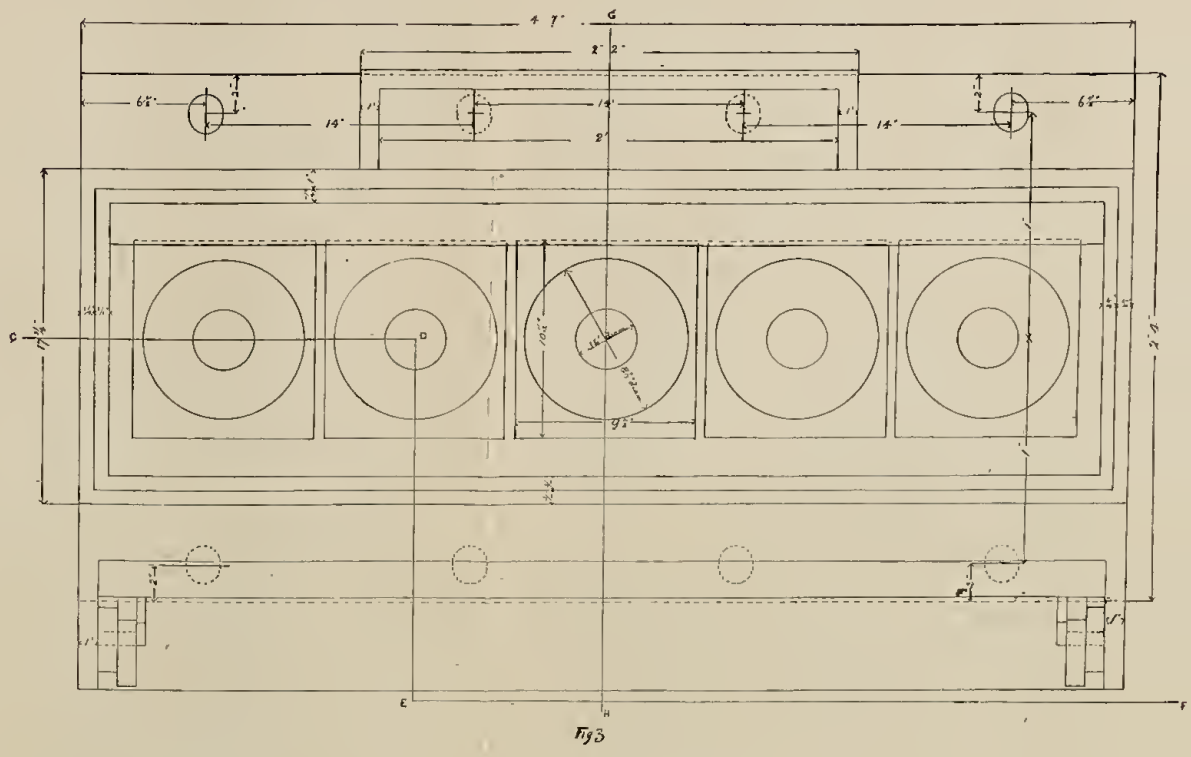


Fig 3

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shapes. Turn where we may, our eyes rest on hills that project above the lowland, not because they have been

up with apparently the most cheering prospects, and all looked forward to a great impetus in mining develop-

occult understanding, a bear told off to attend them. I expect a sort of courtesy shown by the hierarchy of bears. It is nevertheless true, each party will always have a bear

looking after him or them. Our friends had an interview with their attendant sprite, with the result that they sold off everything as it stood and left for the East, vowing anathemas against the country and its inhabitants. No one knows what took place at the interview, but the result was palpable.

The Government have sent Mr. E. D. Ingall to survey the different mineral localities between here and Kootenay Lake, and doubtless the result will be some important and reliable information on this new section. By the way, the last report that came out was for '89 to '90, two years old, and therefore almost valueless to a stranger. Such are the methods of red tape and economy.

The Lardeaux country is coming to the front for placer gold, and also big ledges of silver, lead and galena. It will be heard of prominently soon, but the old drawback (which time and money only can overcome) of no trails, or, at least only tracks, prevents much prospecting being done. Most encouraging accounts are heard of the prospects. For some reason the amount appropriated for the making and repairing of trails was curtailed, for this district, by $3,000, and much dissatisfaction was the result. The district has been divided into two divisions, and they are not evened up yet. Altogether, the outlook is promising and encouraging.

E. A. WATSON.

ILLECILLEWAET, 7th August, '92.

MINING NOTES.

[FROM OUR OWN CORRESPONDENTS.]

Nova Scotia.

Caribou District.

Little is doing in this district apart from the mines of Messrs. Dixon, Putnam *et al*, which continue their steady yield. The product for August is expected to be greater than usual.

The old Lake Lode property, sold at sheriff's sale some months ago, still lacks a speculative purchaser.

East Rawdon.

It is reported that Mr. Brown, the principal owner in the old Rawdon mine, intends to re-open the property. It is known that one or two men have been sent up to make a start, and that a representative will shortly arrive from England. This is the property whose surface plant was destroyed by fire in 1889.

Killag.

Mr. D. S. Turnbull, manager of the Old Provincial Co., reports the mill ready to start at five days' notice. The shaft, however, is not yet down deep enough to start off levels, and the mill, as yet, has no supply of quartz. The lode is reported to be a strong one, showing eight to ten inches of quartz which prospects well in gold. The surface plant has been re-arranged by Mr. Turnbull, and will be of ample power for some time to come. The electric plant for lighting and for drilling has not been received, delay having been encountered in the manufacture of the same. The drill it is proposed to put in is the invention of Mr. McKay, one of the owners of the property, and is said to be the most promising electric drill that has yet been made.

Lake Catcha.

It is understood that Mr. J. M. Reid, the manager of the Oxford mines, has been very successful in his attempts to get pay gravel on the property of the company, and that the results have shown good margins for profit. It is also reported that the underground work looks better than for a long time past.

Montagu.

On the 1st of August, the properties in this district which have been so long under negotiation for sale to London parties, were transferred by Manager McQuarrie to Mr. W. H. Harrington, the financial agent in Halifax of the London syndicate. Mr. Lucius J. Boyd has been temporarily placed in local charge of mines, which embrace the Rose, Annand, Montreal and Lawson. It is understood that the sale has been made to a few gentlemen in London, who purpose promoting a joint stock company so soon as the condition of the London financial market will permit.

Major Johnson, representing the syndicate which purchased the Oland property two months ago, has arrived out from England and has taken over the charge of the Oland property, temporarily in Mr. Boyd's care.

Oldham.

The operations of the Concord Mining and Crushing Company appear to have been brought to a permanent standstill. The liabilities of the company are reported still unsettled.

The Rhode Island Co., after sinking over 100 feet, cut the Dunback lode on its western extension on the 20th inst. The lode showed only two inches of black, barren looking quartz. This is the third place on the property on which this lode has been cut, and each opening failed to show pay quartz.

It is reported that the Oldham Gold Co. will permanently close its Baker mine in September. The extensive prospecting work done underground during the past two years having failed to show any paying proposition.

Stormont.

The work of the MacNaughton Gold Mining Co. at Seal Harbor has been suspended, pending investigation by the company of its own affairs. The same company is operating at Country Harbor, and it is reported have had an expert examining into matters there also.

The recent decision by the Privy Council in the case of the Palgrave Gold Mining Co. vs. McMillan, is of great importance to this district as it will permit the re-opening of the Palgrave mine on Hurricane Island, a mine which, at the time of its closing down, was a steady producer and employed a large number of men.

The North Star Co., on the west side of Isaacs Harbor, have re-opened their workings under the management of Mr. Roderick McLeod, formerly at the Parker-Douglas mine, Queens County.

Tangier.

The property of the Mooseland Co., under the management of Mr. H. G. Stemshorn, is increasing in value daily. The Bismarck lode has narrowed to about two feet, but has increased in value from 4 dwts. to over an ounce to the ton. With continued good management this property should become a marked gold producer.

Quebec.

Lievres River.

Only four phosphate mines are in active operation at the present time. The High Rock mine of the Phosphate of Lime Co., the Ross Mountain mine of the General Phosphate Corporation, the Etna and Squaw Hill mines of the Anglo-Continental Guano Works Co.

Two properties are being worked for mica, being the Lake Terror mine in Portland West, and north of this property and further up the river near High Falls, Mr. McIntosh is mining dark mica.

An asbestos mine has been opened near Farley Lake, in Portland West. The Lomer and Harris crushing mills at the Basin du Lievre, are at present grinding the asbestos from Templeton Township.

Jacob Weart of the Graphite Lubricating Co., Jersey City, is operating his plumbago mine and the mill by the dry concentration process, and this manner of dressing the ore is now a success, as one and a half tons of the dressed product have been shipped to the United States. One hundred tons of low grade disseminated graphite ore are being shipped to England on trial from another property.

Eastern Townships.

The Richmond *Guardian*, under date of 9th inst., contains an interesting description of the mining operations for asbestos, carried on by Mr. W. H. Jeffrey, on lot 9, in 3rd Range of Shipton, widely known as the Jeffrey asbestos mines. The article is too long to be reproduced in full, but the following particulars will be of interest: "We visited the Shipton mines this week, and we found a change there, and in its surroundings, which is simply marvellous since we visited the place five or six years ago. Mr. Webb's farm house, Mr. Morrill's, and the school house near by, were then the only buildings near the mine, while at the mine itself, the office, a small slight wooden structure for the manager, a blacksmith's shop, and a couple of rough sheds for sheltering the men doing the "cobbing," were all that was to be seen; there is now a village crowding round the mines, and substantial houses 80 in number, many of them of a comfortable and neat appearance, and between 600 and 700 people, all dependent upon the mine, inhabit them. There is also a post office as well as a thriving well-stocked general store. At the mines, also, there has been a complete transformation. There are powder magazines—four large well appointed engine houses, store houses, cobbing houses, tooling sheds—and other buildings, all of the most perfect character, and "built to live"—nothing being temporary—there are no less than seven enormous derricks operated by powerful model steam engines; only one—that at a small auxiliary pit is now operated by horse power. The pits are five in number—including the small one referred to; they vary in depth from 75 to 130 feet and the larger ones are, we should judge, 400 feet in width. They are working on the walls towards each other; so that in a few years the whole vast area will be one enormous pit, except in one place, where a vein of bastard granite carrying masses of iron pyrites was struck, and which is about 80 to 100 feet in width; the entire rock is asbestos and a large proportion of the veins are of No. 1 quality—the fibre being about 1½ inches in length. The workings cover altogether about 40 acres and the entire property is 75 acres. The quantity got out averages 8 tons per day—though during the week ending the 6th instant 59 tons were got out and bagged ready for export. Speaking generally, 50 per cent. of the whole ranks No. 2, 10 per cent. is No. 1 and the balance is No. 3, though there is, besides, a No. 4 quality which is made from the "scrappings" and is found to be a readily handled commercial article. There is now ready for shipment about 600 tons, and Mr. Jeffery has 150 tons stored in Montreal One hundred and thirty hands is the regular staff employed, and the wages paid amounts to $4,000 per month."

South and south-west of the great dumps, down on the lower level are the engine houses recently erected by Mr. J. C. Bedard and Mr. N. Noel—the latter for a Philadelphia company—both of whom are about to engage in making these huge dumps tell what they are worth in asbestos. The contents of these dumps are the huge stones from which Mr. Jeffery had taken asbestos. They are going to crush them by a new patented process with the expectation of taking from them the asbestos that is still embedded in them. It is an experiment; but it is believed that sufficient will be found to pay a handsome return on the outlay these two companies propose to invest in the venture.

CANADIAN COMPANIES.

The Hastings Mining and Reduction Co. (Ltd.)—This company gives notice of application for charter of incorporation under the Ontario Joint Stock Companies Act. Authorised capital, $100,000 in 1,000 shares of $100. Directors: F. B. Allan, Toronto; W. H. Wylie, Carleton Place, Ont.; Mrs. Theresa Allan, Toronto. Formed to explore for, mine, treat, reduce, smelt, separate, convert, amalgamate, refine, manufacture, buy, sell and transport gold, silver, copper, iron, iron pyrites, lead and other ores, metals, minerals, and mineral substances, and to utilize the by-products in such minerals and ores. For these purposes to acquire and hold by purchase, lease, or other legal title, lands, mines, leases, etc., etc. Head office: Toronto, Ont. The operations of the company are to be carried on in the counties of Peterborough, Hastings, Addington, Frontenac, Lanark and Renfrew.

The Toronto Chemical Co. (Ltd.)—Authorised capital stock, $100,000 in 2,000 shares of $50 each. Directors: Arthur English, Oliver B. Shepherd, Charles Gordon Richardson, all of Toronto; Henry Shepherd, Orillia, and William H. F. Russell, Waubaushene, Simcoe Co. Head office: Toronto. Formed to carry on the business of purchasing and treating all manner of ores and their by-products, and to carry on in all its details and branches the business of smelting and refining of ores, with full power for that purpose to purchase all patents covering all and every process in connection with the carrying on of the said business. Also to hold real estate sufficient for the purposes of a place of business and for the supplying of dwellings to employees; also with power to purchase mining properties to be worked in connection with said business. The operations of the company are to be carried on in the Province of Ontario.

The Crescent Nickel Mining Co. of Algoma, (Ltd.)—Capital stock, $200,000, in 20,000 shares of $10 each. Directors: John W. Cheeseworth, merchant; William A. Dewar, George Peter Sharp, Herbert A. Hilyard, broker; and Henry Morgan, hotel keeper, all of Toronto. Head office, Toronto. Formed to acquire, sell, and dispose of, and generally deal in mining claims in the Province of Ontario, and work and operate mines thereon, and smelt and refine, sell and dispose of minerals found thereon.

The Sarnia Salt Co., (Ltd.)—Incorporated 28th July, 1892. Capital stock, $20,000, in 400 shares of $50 each. Directors: Harrison Corey, of Petrolia, County of Lambton; Martin Jesse Woodward, of Petrolia, County of Lambton, oil operators; Wm. Keenleyside, of Sarnia, Ont., merchant; Henry H. Green, of Tp. of Moore, Ont., grain merchant; Jas. H. Kittcmaster, of Tp. of Moore, Ont., oil operator. Formed to acquire the plant, premises, business, stock-in-trade, credits and assets of every kind and description of the Sarnia Salt Co., and to carry on the business of the said company in the production and manufacture of salt and of all other articles that may be made therefrom. To sink and work artesian wells; to procure salt, petroleum oil, natural gas or other minerals; and with the consent of the parties interested to lay down and work pipe lines for carrying and conveying brine, petroleum oils, natural gas and other fluids; and, for the purposes aforesaid, to manufacture barrels and to buy, sell, or deal in any, or all of the articles aforesaid; and to enter into contracts and do all such other matters and things as are necessary, incidental or conducive to the due attainment of the said objects or any of them.

The Eagle Nest Gold Mining Co. of Ontario, (Ltd.)—Incorporated 3rd August, 1892. Capital stock, $200,000, in 2,000 shares of $100 each. Directors: Alex. McArthur, lumber merchant; Reuben Millichamp, merchant; Geo. Alex. Shaw, Lieut.-Col.; William Howard Hunter, barrister-at-law; Nelson Mills, barrister-at-law; all of Toronto. Formed to acquire, hold, lease, exchange and sell mining lands, and to develop the said lands by working mines, smelters, stamping mills and other necessary works.

Eustis Mining Co.—The annual general meeting of this company was held on 10th instant at Capelton, Que.

Ontario Natural Gas Co., (Ltd.)—This company makes application for a grant of supplementary letters patent, increasing its capital stock to $100,000.

Amherst Red Stone Quarry Co., (Ltd.)—This company gives notice of application for charter of incorporation under the Nova Scotia Joint Stock Companies Act. Head office, Amherst, N.S. Capital, $6,000, in sixty shares of a value of $100 each. Directors: John McKeen, James Donalds, and Thomas Dunlap, all of Amherst, N.S. The purposes for which the said letters

patent are sought are the opening and working of stone quarries of all kinds within the County of Cumberland or elsewhere in the Province of Nova Scotia, and for manufacturing the products of such quarries, and for the selling and exporting the said stone and products in any form whatever; and further, for the purpose of carrying on business as builders and contractors, and for the purpose of purchasing, leasing or otherwise acquiring any lands or other property necessary for the objects aforesaid, or any of them; and for selling or otherwise dealing with the same; and for the transacting of all business connected with the purposes aforesaid, or any of them.

The Laprairie Pressed Brick and Terra Cotta Co.—Capital stock, $150,000, in 1,500 shares of $100 each. Directors: Hugh Cameron, Toronto; Archibald Dunbar Taylor, Montreal; Thomas Auguste Brisson, Laprairie; William Johnson, Montreal. Head office, Montreal. Formed to manufacture bricks, tiles and all other articles from clay or shale.

Economical Coking of Coal, with Recovery of the By-Products.

The Bois-du-Luc Company owns and works, in addition to its royalty proper, the colliery of Havre, near Mons, Belgium; but it has so happened that just where working was begun the coal measures have been disturbed by two extensive faults, and the coal is rendered so friable as to greatly diminish its commercial value. Under these circumstances the best course to pursue was manifestly to make coke on the spot. But the coal, without being absolutely poor, only contains generally from 18 to 23 per cent of volatile matter; that is to say, it is only just capable of being coked, while some of it contains as little as 16 per cent of volatile matter. In 1882 M. Semet put up 6 of his coke ovens, which were experimented with for about a year, after which the Solvay Company erected a set of 25 ovens, which the Bois-du-Luc Company subsequently took over, extending them to 4 sets of 25 each, capable of coking from 100 to 110 tons of coal per 24 hours, and working them on its own account. The gas generated from the coal in the combustion chambers of the ovens is led by a collecting flue through the boiler flues (each set of 25 ovens firing 2 Havrez boilers of 75 square metres (810 square feet heating surface), and up the chimneys 25 metres (82 feet) high, and 1.6 metre (5 feet 3 inches) in their smallest diameter. The discharging floor is on a level with the tops of railway coke waggons, and the discharging is effected mechanically from the opposite side, by steam rams moved along their rails by endless chain and fixed capstan, in such a way that, in case of a breakdown, a single ram can discharge all the 100 ovens. The rams are supplied with steam from the boilers by a fixed pipe running the whole length of the ovens, and connected by movable elbow joint pipes. The steam also drives pumps for rising the water required for quenching the coke, the tar and ammoniacal liquor pumps, the disintegrators and the gas exhausters. The gas, drawn by the exhausters, passes first into the hydraulic mains, of which there is 1 to each set of ovens, and successively through the condensers, the exhausters and the scrubbers, into the boiler flues. The hydraulic main is so arranged that the gas is obliged to pass through water, which has the effect of cooling it rapidly, and thus preventing the formation of hard tar. The condensers are water-jacketed, and the scrubbers have 7 superposed chambers, in which the gas, finely subdivided by perforated plates, passes through water. The exhausters are of the Beale type, capable of drawing 35,000 cubic metres (1,225,000 cubic feet) in the 24 hours. There is 1 exhauster, driven by an engine, to each set of ovens, so that its speed may be regulated to suit the working of that set of ovens. The tar and ammoniacal liquor are received in a tank, whence they are pumped into large reservoirs, mounted on towers, sufficiently high to permit of their flowing into the tank waggons. The coal, brought in 10 ton waggons from the pit mouth, is raised in elevators to the Carr disintegrators, driven at 600 revolutions per minute. The ground coal is led by trucks, opening at the bottom, directly over the ovens, which are changed by shafts in the ordinary manner.

The distinguishing feature of the ovens themselves is that the gas flues, instead of being formed as usual in the walls of the ovens, necessitating their being almost completely pulled down to effect repairs, are made of fireclay flues or retorts, in lengths fitting into one another with socket joints, and in 3 superposed heights or stages on either side of the coking or combustion chamber. In this way the heat is evenly distributed and easily transmitted through the thin sides of the gas flues, while the latter may be readily repaired or renewed without interfering with the main structure of the ovens. Experience shows that this arrangement favors rapid calcination, and therefore a high production per oven, while the reduction of joints to a minimum, and therefore the prevention of direct passage of gas into the ovens, increases the yield of sub-products. The inside dimensions of the ovens are: Length 9 metres (30 feet); width at front end, 38 centimetres (1 foot 3 inches); and at back, 36 centimetres (1 foot 2 inches); height, 1.7 (5 feet 8 inches); the walls being 2 bricks or 16 inches thick, and the sides of the gas flues or retorts, 7 centimetres (3 inches) thick. The mass of brickwork above the vaulted roof of the ovens is 1.2 metre (4 feet), so as to reduce loss of heat to a minimum and favor an even distribution of heat. The ordinary luted doors are also protected by outer doors of sheet iron against the cooling influences of the weather; other openings, such as the charging shafts and the cleaning holes in the ascending gas pipes, are closed by tight covers, kept against their rests by springs. That no outer air enters is proved by the batch of coke when drawn, which shows not the slightest signs of combustion; and therefore the yield of coke is very high, viz., 81 per cent. of the coal charged, or very nearly the theoretical yield. To more evenly distribute the heat the gas is introduced at two separate points, part at the back end of the upper row of gas flues or retorts and the other part at the front end of the middle row, while the air necessary for combustion, previously heated to a temperature of 200 or 300° C., is admitted at the first inlet. The gas enters its flues by gauged orifices, so as to be evenly distributed over all the flues of all the ovens. Although the ovens work at a high temperature, that of the escaping gases barely reaches 200° C. at the base of the chimneys. Of the 16 or 17 per cent. of volatile matter contained by the coal, there are 4.5 per cent. water and 1.5 per cent. tar, which are condensed, leaving only 10 or 11 per cent. available for heating. Only about half of this quantity is used for firing the ovens, which have no supplementary fires as in other ovens with recovery of the by-products. The remaining half of the gas is used to fire the boilers, or allowed to escape into the air, when, as is frequently the case, the requisite pressure is exceeded. Moreover, the quantity of steam generated more than suffices for the requirements of the works, the excess being sent to neighboring works for converting the ammoniacal liquor into alkali or sulphate of ammonia. Before the by-products were recovered the excess of gas was used to light the works; but it is now deprived of its illuminating properties, which, however, can, of course, be readily restored by passing it over cheap hydrocarbons.

The ton of coal produces 16 cwt. of hard blast furnace coke, 31 pounds of tar and 13.5 pounds of ammonia calculated as sulphate of ammonia. The by-products obtained with every ton of coke are worth 1s. 6d. Deducting 3d. for the extra expense incurred in their production, the 1s. 3d. left constitutes a handsome return for the extra capital sunk in plant for their production. An ordinary oven producing only 60 tons of coke per month, and without recovery of the by-products, costs £80; for 100 tons per month the figure would be £133 6s. 6d. But the Semet-Solvay oven for 100 tons with recovery, costs £260. The difference, viz., £126 13s. 7d., yields £72 per annum, or 57 per cent., on the additional capital sunk for recovery of the by-products, and this not only without supplementary heat, but also with a considerable excess of available heat, from coal containing so little volatile matter that it can only just be coked.—*Iron and Coal Trades Review.*

The Mining Society of Nova Scotia.

The next quarterly meeting of this Society will be held at Londonderry on 7th September next. Papers will be read by Mr. David McKeen, M.P., on "Coal Cutting in Cape Breton;" Mr. R. G. E. Leckie, on the "Iron Deposits of Torbrook;" and by Mr. John E. Hardman, on the "Crawford Mill." Mr. R. G. Leckie will also, it is understood give a description of the new furnace plant and equipment recently installed at the Londonderry works. An after session will be held in Truro on the same evening.

Electric Drill.—An electric drill is in use at the Brooklyn Navy-yard for drilling holes in ships' plates from ½ to 1½ inch thick, or more, in positions where the use of a power drill is almost impossible. The box containing the drill is 18 inches in length over all; it contains the motor and a flexible shaft, 6 or 8 feet long, for working the drill. The motor runs at 2,800 revolutions per minute, and is geared down. An inch hole can be bored through half-inch iron in less than 30 seconds.

Fire Hazard.

Prof. Charles B. Gibson of Chicago, in his special report to the insurance companies on the "Hazard of Steam Pipes" and upon "Coverings for Steam Pipes," says: "All organic matter, such as hair felt, becomes more or less charred by constant contact with hot steam pipes, even though the temperature be but a little above the boiling point of water; and by steam of 300° F. and above, so thoroughly scorched after a time as to become very fragile, and to crumble away rapidly. It is noticeable that the dust formed from this charred material *is very combustible* and will flash like gunpowder when thrown into the fire. "When steam of high temperature is used it is by far the safest to employ a covering wholly incombustible."

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Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

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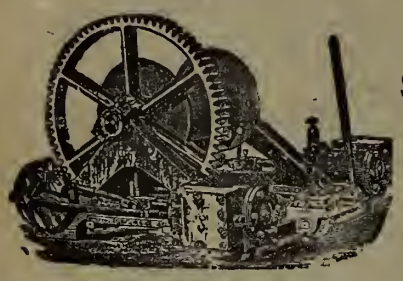

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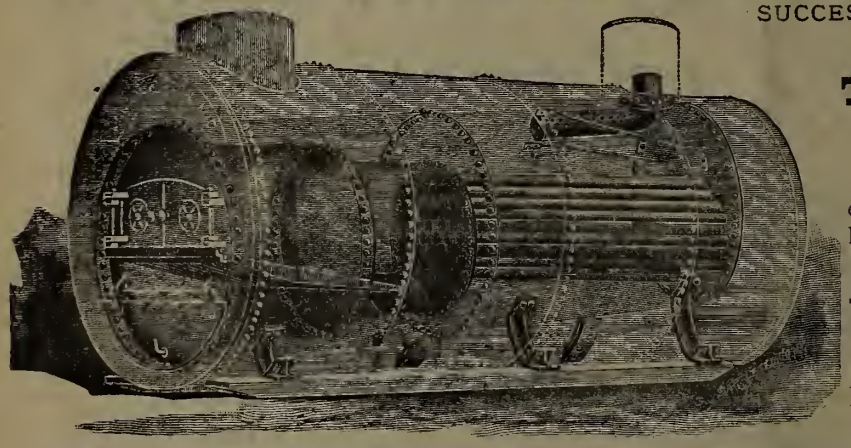

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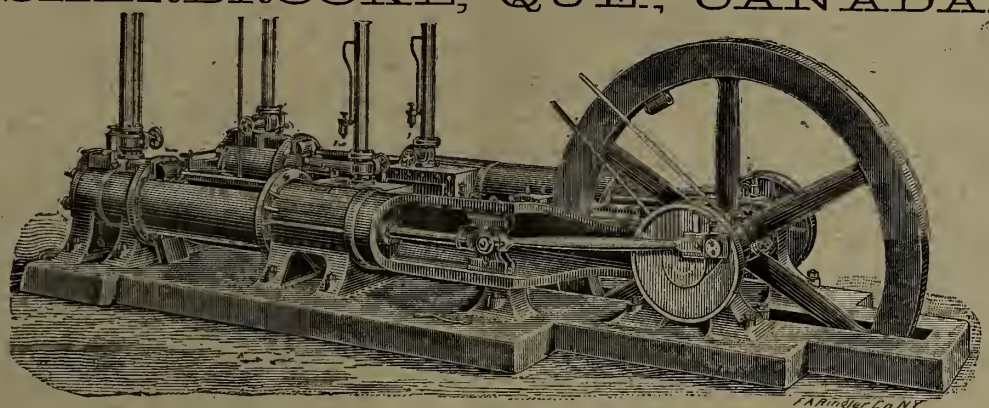

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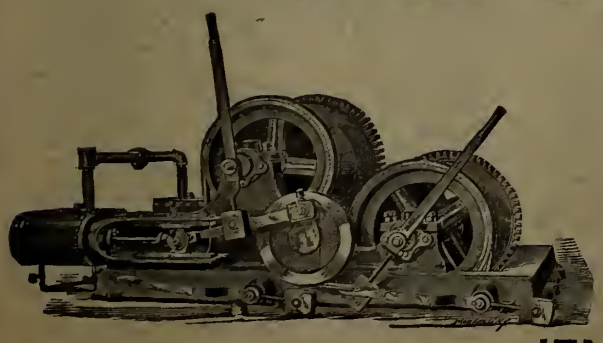

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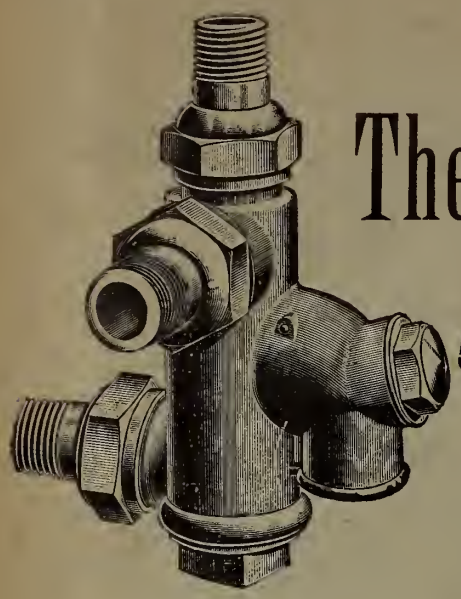

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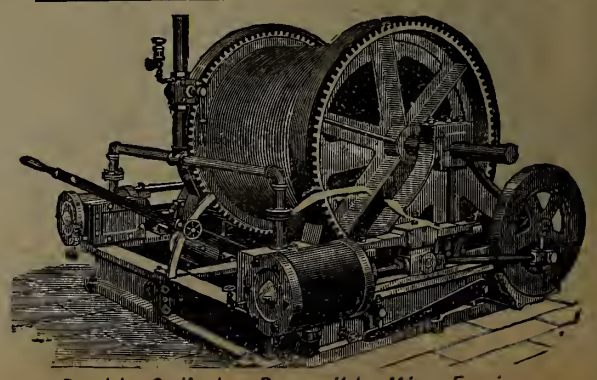

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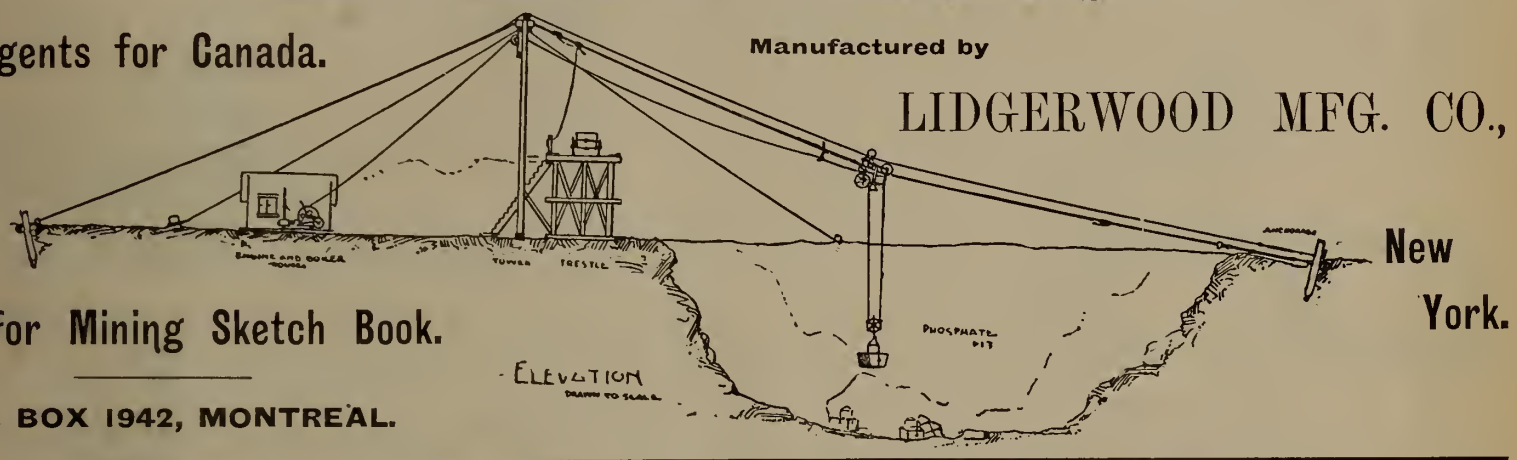

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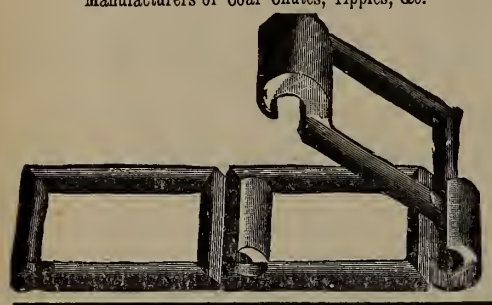

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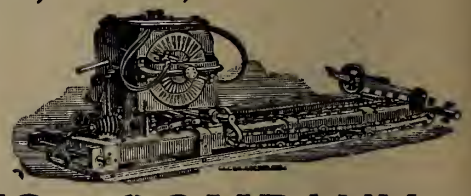

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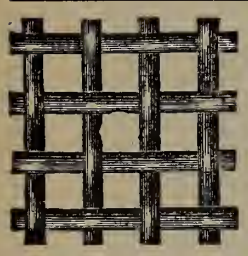

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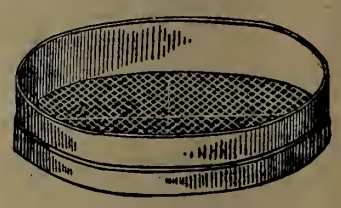

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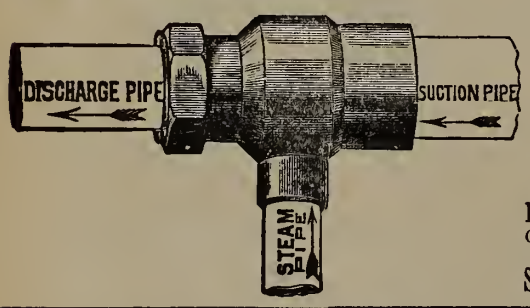

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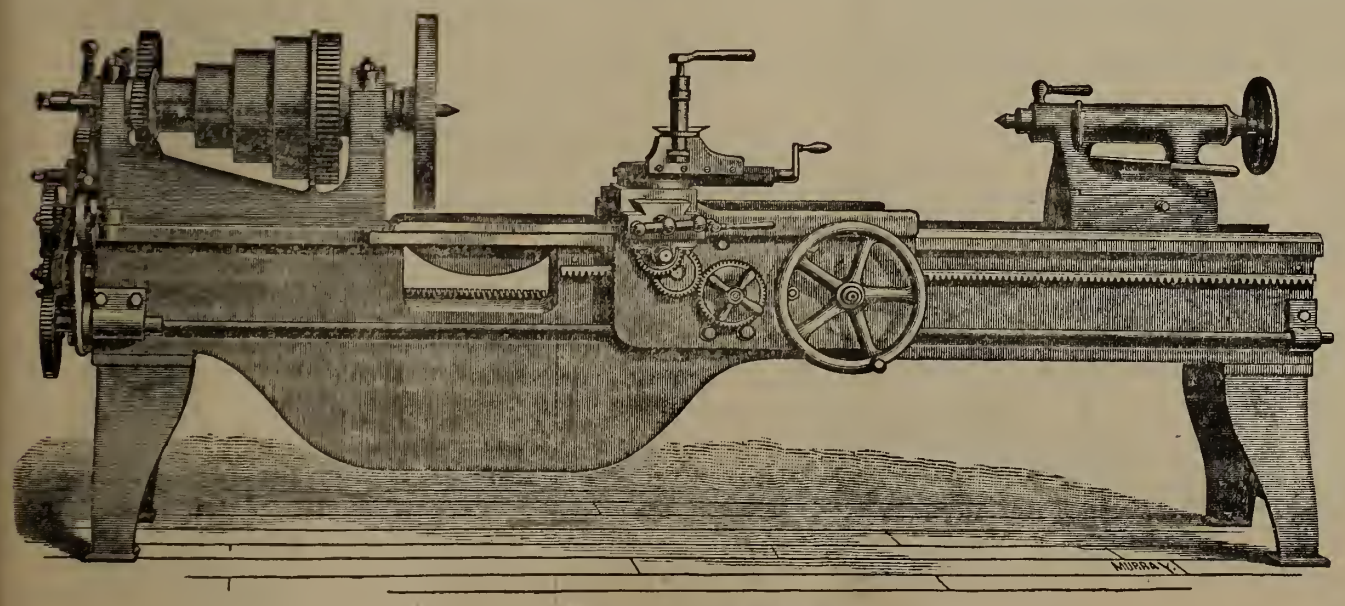

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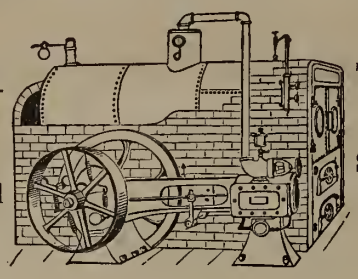

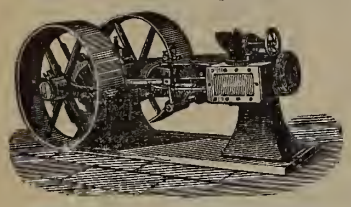

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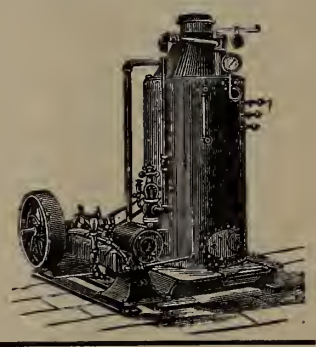

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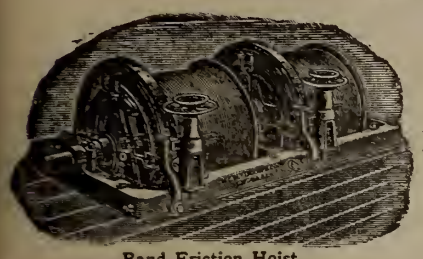

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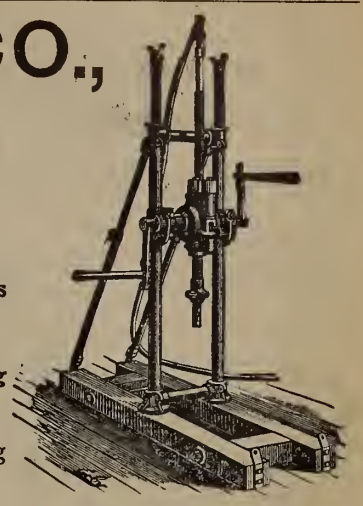

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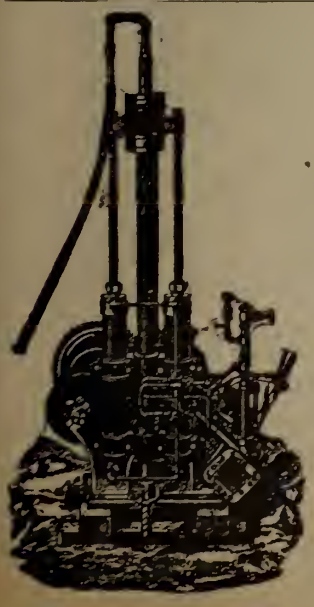

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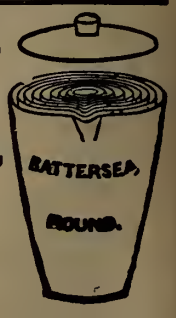

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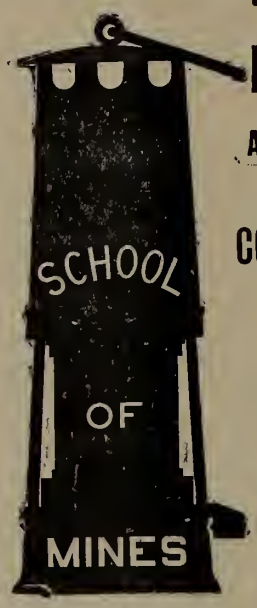

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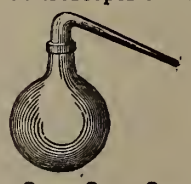

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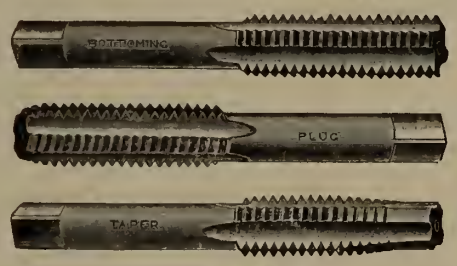

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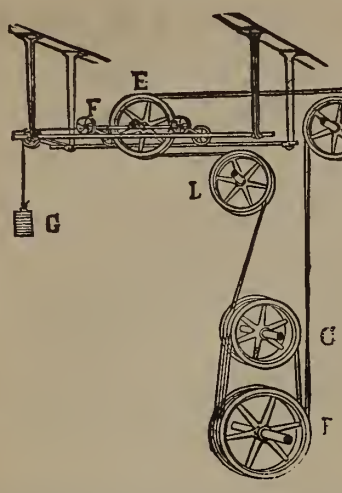

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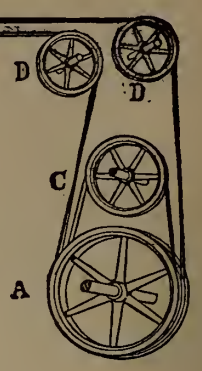

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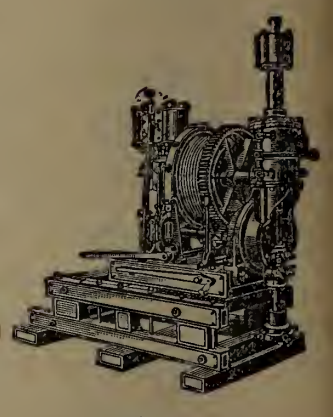

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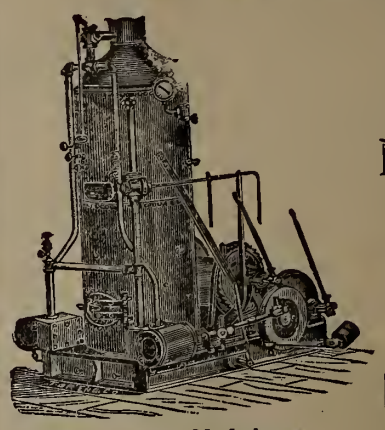

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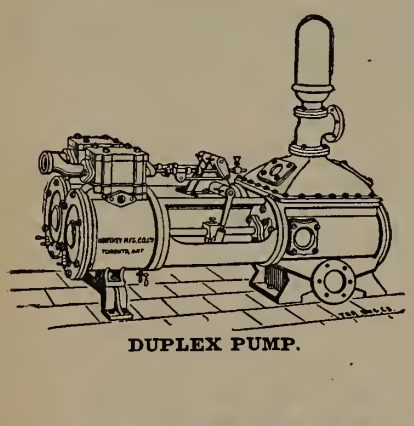

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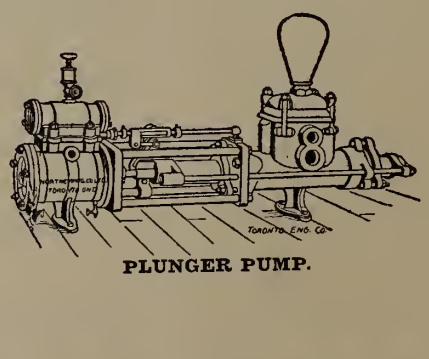

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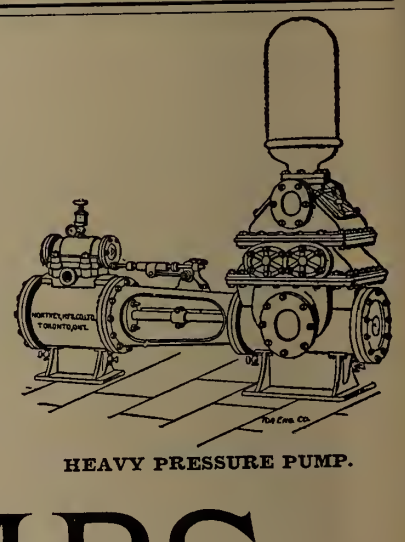

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CANADIAN MINING & MECHANICAL REVIEW

CONDUCTED BY . . . . . B. T. A. BELL.

THE OFFICIAL ORGAN

—OF—

THE GOLD MINER'S ASSOCIATION OF NOVA SCOTIA,

THE UNITED MINING SOCIETY OF NOVA SCOTIA,

THE ASBESTOS CLUB, QUEBEC,

THE GENERAL MINING ASSOCIATION OF QUEBEC.

THE following Resolutions of Council indicate beyond a peradventure the status of THE REVIEW as the exponent of the Canadian Mineral Industries :—

The Gold Miners' Association of Nova Scotia.

"At the annual meeting of the Gold Miners' Association nf Nova Scotia, held at Halifax on 6th March, 1889, THE CANADIAN MINING REVIEW was adopted the official organ of this Association.

(Signed), B. C. WILSON, *President.*
G. J. PARTINGTON, *Secretary.*

The Mining Society of Nova Scotia.

"Moved by Mr. R. G. Leckie, seconded by Mr. C. A. Dimock, That the thanks of the Society be tendered to Mr. B. T. A. Bell for his kind offer placing the columns of THE REVIEW at the disposal of the Society; and that THE CANADIAN MINING REVIEW is hereby appointed the official organ of the Society."

(Signed), H. S. POOLE, *President,*
H. M. WYLDE, *Secretary.*

The Asbestos Club, (Quebec.)

"Resolved: That THE CANADIAN MINING REVIEW is, by authority of the Members and Council, hereby appointed the official organ of the Asbestos Club."

(Signed), D. A. BROWN, *President.*
A. M. EVANS, *Secretary.*

The General Mining Association of the Province of Quebec.

At a meeting of Council held at Montreal on Friday, 6th May, 1891, it was moved by Captain Adams, seconded by Mr. R. T. Hopper, and resolved: That THE CANADIAN MINING REVIEW be the official organ of the Association.

(Signed), GEORGE IRVINE, *President.*
B. T. A. BELL, *Secretary.*"

OFFICES:
Victoria Chambers, 140 Wellington Street,
OTTAWA.

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Iron Making in Nova Scotia.

The advancement of this important industry in the Province of Nova Scotia during the present year. has afforded a pleasing contrast to the general dulness in mining matters. In the coal, iron and gypsum industries, little gain has been made up to the present date, although it is expected that greater activity will be seen during the remainder of the year.

The announcement of the successful blowing in of the New Glasgow Iron, Coal and Railway Company's furnace at Ferrona, in Pictou County, is a welcome one. This is an important step ahead and a legitimate one. Nowhere on the Atlantic coast are varied iron ores, fluxes and fuel, found in the same juxtaposition and under equally favourable natural conditions for transport, access and facilities for mining, smelting, and local markets. It is yet too soon to state accurately the regular yield of the furnace, but already local foundries and other works are utilizing a good and cheap pig iron smelted at their doors. There is now a foundation along the East River of Pictou, for a score of iron, metal, shaping and moulding factories, to deal with the varied requirements of the farmer, shipbuilder, coal miner, etc. The new railway of the company intersects the band of ferriferous strata extending for fifty miles from the French River, and which is crossed by the Intercolonial railway at each end.

The operations of the company have disclosed large and valuable veins of brown hematite, from which, if desired, over 400 tons of ore can be raised daily; the present output being about 200 tons. Their fluxes are quarried alongside the iron ore. In this large territory there are several valuable properties as yet untouched, among which may be mentioned the Bartlett areas covering some twelve square miles of several varieties of iron ore, and the Holmes property, similar in extent and in the variety of its ores.

The development of this wonderful repository of the most valuable of the ores of iron has not been confined to the New Glasgow Company. The Pictou Charcoal Iron Company has acquired several tracts of excellent brown hematite ore on the line of the new railway, and having erected the necessary furnace, buildings, foundries, etc., is entering upon the manufacture of charcoal-iron, car wheels, etc.

There is room at present for another furnace here, and for plants to make bar, sheet, and other iron, and for another steel works similar to that at Trenton, near New Glasgow. So much for the present; there can be no doubt that in five years' time there will be an opening here for many times the present production of pig, steel, etc.

There are large tracts in this district still unexplored and at the disposal of the Government, and the owners of the leases and other properties proved to contain iron ore, are willing to assist in every way the further introduction of capital. During the present year interested parties have surveyed a line of railway about sixty-five miles in length, to connect the railway of the New Glasgow Company at Bridgeville with Country Harbor, one of the best ports on the Atlantic This road runs for its greater length through a fertile river valley past several important gold mines, and when completed, will form a ready outlet for every industry in Pictou County, and indirectly promote the iron business.

At Londonderry work has been continued with more satisfactory results. At Torbrook, in Annapolis Valley, the iron mined is of excellent quality (the ores are fully described elsewhere in this issue), and has been much appreciated at the Londonderry furnaces which take the output of the mine. This property is well equipped with modern machinery and can furnish 200 tons a day. There are several other veins of good quality in this district, and they may be utilised for mixture with the East River limonites for the New Glasgow Company's furnace.

Enquiries are also being made by parties who contemplate re-opening the Clementsport mines in Annapolis County, and commencing the manufacture of charcoal iron. These encouraging facts warrant the hope that the iron industries of the Province are beginning to grow steadily if slowly.

EN PASSANT.

The Department of Crown Lands, Toronto, has just issued, in handy pamphlet form, the Mining Act of the Province.

We regret to record this month the death of Mr. John Weir, Underground Manager at the Caledonia Colliery, Cape Breton. Mr. Weir was in the prime of life and was highly esteemed by the coal men of Nova Scotia.

At the meeting of the Asbestos Club, to be held in the Club House, at Black Lake, Que., on Thursday, 29th instant, Mr. J. Obalski, Government Mining Inspector for the Province, will read a paper on "The History of Mining in Quebec."

The members of the Mining Society of Nova Scotia who turned up at Londonderry on 7th instant were rewarded with a thoroughly interesting and enjoyable outing. Charming weather favored the event, and the attendance was creditable. The proceedings included a visit to the smelting works of the Londonderry Company, a number of valuable papers descriptive of the new plant in place, and the nature and occurrence of the ores mined and treated in the neighbourhood. Through an unfortunate misunderstanding the visit to the East and West mines was very reluctantly abandoned in order to permit the party returning by an early train to Truro. Too much praise cannot be given to Mr. R. G. Leckie and his co-workers on the local committee for the very excellent arrangements provided for the reception and entertainment of members while in Londonderry.

The following account of the process invented by Drs. Readmann and Parker for obtaining phosphorus in an electrically heated furnace, is taken from the *Electrotechnische Zeitschrift* through the *Chemiker Zeitung*. The furnace is made of refractory materials in a rectangular trough shape 1·5 metres long, 0·5 metres wide and 0·9 metres deep, a cast iron tube being built in each side, through which pass the carbon electrodes. The electrodes are compound, consisting of a bundle of 9 thin carbons, 1·2 metres long and 63 mm. thick, and can be moved forward as consumed by a screw. In reducing the metaphosphates, peat is used instead of fine coal. The crude material is introduced through a funnel which prevents the loss of heat ores or escape of phosphorus vapor. The vapor of the phosphorus is conducted to copper condensers. The phosphorus produced by this method is so pure that little or no refining is required, and in consequence the profits are large.

The gold and silver and other mineral exhibits at the Chicago World's Fair will probably aggregate in value several million dollars. In exhibits of this description it is expected that Colorado will take front rank. It is announced that the gold and silver nuggets to be shown by that State alone are worth 250,000 dollars. There has been made a splendid collection of

native gold specimens from all the rich mining districts. A single collection, valued at 60,000 dollars, has already been secured. This will be supplemented by the finest collections secured as loan exhibits. The exhibit will be both technical and economic in its character, showing a scientific classification of the mineralogy of Colorado and a correct presentation of its geology. At the same time a popular and massive display of ores, building stone, commercial clays and other mineral products will be made. Models, maps and diagrams will be employed to show the progress made in mining. These will be accompanied by historical data and reliable information regarding the product and formation of veins in the mining districts. In the display will be the "Silver Queen," a beautiful statue of an ideal female figure executed in silver, and valued at 7,500 dollars to 10,000 dollars.

Dr. David T. Day, Chief of the Division of Mining Statistics and Technology, United States Geological Survey, has issued his annual report on the "Mineral Resources of the United States," for the calendar years 1889-90. The volume covers about 700 pages, and, as usual, contains a vast amount of valuable information respecting the mineral industries of our progressive friends across the line. We often wonder, in referring to this work, how long it will be before our own Survey becomes alive to the necessity of a yearly publication that will give the public something beyond a mere compilation of antiquated and useless statistics.

A most encouraging outlook for the mica industry is its connection with the increasing use for the scrap product, which accumulates in about the proportion of ten pounds of waste to one of cut sheets, even when the cut sheets take in the smaller size used for stoves. By mills located at different points in the United States, notably in Denver, Richmond, New York and Boston, a large proportion of this is now ground and used for making lubricants, for insulators, and in wall paper.

According to Dr. Day's report, the States producing mica in 1889, were New Hampshire, North Carolina, Virginia, and South Dakota. The total product in that year was 49,500 pounds, valued at $50,000 at the mines in the condition it was first sold. In addition to this, 196 short tons were sold for grinding purposes, with a value of $2,450. In 1890 there was an improvement. The product aggregating 60,000 pounds, worth $75,000 at the mines. The sale of scrap mica, sold for grinding purposes, increased also to 300 tons.

No new deposits of nickel of proved value, writes Dr. Day, have been found in the United States, although discoveries have been reported in North Carolina, the Black Hills of South Dakota, and in Idaho; the Gem mine, in Fremont County, Colorado, was developed slightly. The Canadian mines, therefore, continue as the chief factor in the supply of the world. Dr. Day estimated the total yield of metallic nickel from Canada in 1889, at 2,500,000 pounds contained in matte, which formed the article of export; and in 1890, 1,336,627 pounds.

The New Caledonia mines still continue to furnish a proportion of the world's supply, although the deposits are pockets of uncertain extent. Dr. Day reports the cost of mining as being considerable, the labor uncertain and the transportation facilities poor.

We clip the following from a recent issue of the *Australian Mining Standard*:

"Our contemporary, the *Canadian Mining Review*, is evidently at one with ourselves in the exposure of mining swindling and swindlers. In its April issue summary justice is dealt out to a Mr. Charles M. Dobson, who, it appears, has been victimising 'leading merchants and capitalists in various parts of the Dominion by posing as a mining expert, an Associate of the Royal School of Mines, &c.' The *Review* now denounces him as a 'fraud, dead beat, and imposter of the very worst character'—an 'unscrupulous and wholly unprincipled person, entirely devoid of any mining knowledge or ability, proved to be a liar almost without parellel.' This is strong language, but we repeat it because it is just possible that Mr. Charles Miles De Tracy Dobson may visit Australia, now that America is too hot to hold him. In the May issue of the *Review* a portrait of Dobson is given. Unfortunately for the public who put their trust in unscrupulous mining experts in these colonies, the action of the press, which often has the information necessary to enable them to issue specific warnings, is trammelled by absurd and unjust libel laws, and we admire outspokenness such as that now referred to, but we are not able to follow such a courageous example without incurring ruinous penalties."

Some interesting facts respecting the gold mining industry is given in the report of the Queensland Department of Mines. There has been a shrinkage in the total yield of 34,148 oz., the figures for 1890 and 1891 being, respectively, 610,587 oz., and 576,439, but increases are recorded on twelve fields as against nine on which there has been a falling off. In the total production Queensland heads Victoria in the inter-colonial race for first place by only 40 oz., while New Zealand comes out as a respectable third with 251,335 oz., and New South Wales with 153,335 oz. Nearly all other branches of mining show a decrease, but as the report says: "The true cause of failure of mining enterprises in so many instances hitherto must not be sought in the poverty of the ground, but, no doubt, the true explanation lies in the fact that the areas tried to be held are so frequently out of all proportion to the capital of the entrepreneurs, and which in only too many instances must be set down as *nil*. I am glad that the old idea, that land applied for to-day for mining purposes by some enterprising individual becomes from that fact alone worth thousands and tens of thousands of pounds to-morrow, is fast exploding, and I trust that but very seldom it will be heard of hereafter. This system has been and I regret to say is even now, retarding the progress of the mining industry, and we shall have to look to the investing public to effect a a radical cure in this direction, simply by looking closely into the *bona fide* values of the properties, and also quite as much into the expenditure of their money afterwards. I cannot see any reason why money put into mining in the great majority of cases should not become as safe an investment as any other."

Some time ago a reduction works was erected at Rat Portage from which great things were expected for the ores from the Lake of the Woods district. But the ignorance and incapacity of the mining quack has again wrought another dismal failure if one may judge from the following remarks of a correspondent: "One hates to be continually on this subject, but it is a difficult matter to keep quiet and see the sinful manner in which good time and money has been wasted through criminal ignorance and incapacity. It is not right to lay the whole of the blame upon the shoulders of the present management, as the costly machinery which has proved so woeful a failure was placed in position by their predecessors. The trouble is that the place has been over-run by adventurers from the other side, who, possessed of a few glib geological phrases and mining terms sufficient to conceal for the time being their abject and total ignorance of everything connected with practical mining, have posed as experts and authorities, and have assisted with their valuable advice in retarding and destroying mining developments in this neighbourhood."

It is stated that the German Government has ordered that in future all official statements on temperature are to be made according to the centigrade scale. In this case the Réaumur scale will probably fall entirely out of use. The three thermometrical scales in general use are those of Fahrenheit, Celsius, and Réaumur—the first used in Britain, the second in France, and the third in Germany. The scale of Celsius is called the centigrade, from the fact that the difference of temperature between the freezing and the boiling points of water is divided into 100 degrees. Fahrenheit divided the same space into 180 degrees, probably with reference to the number of angular degrees in a semicircle, and in Réaumur the same space is divided into eighty degrees. The centigrade is considered the most scientific. The Fahrenheit has the drawback that it fixes zero at a point, namely, 32 degrees below the freezing point of water, which has no special warrant in nature. It is supposed that this was the greatest degree of cold he had himself observed producible by means of some freezing mixture. In the centigrade the freezing point is made at zero, not in the sense of its being the lowest temperature reachable, but as a convenient starting-point, temperatures below that point being expressed by the addition of the minus sign. In this scale – 32 denotes the zero of Fahrenheit. The Fahrenheit thermometer has obtained so firm a hold in this country that it will be difficult to displace it, but it would certainly be an advantage to have the centigrade scale in universal use.

Captain Samuel S. Brown, a colliery owner, of Pittsburgh, a short time ago found it desirable to introduce into his mines electrically-operated coal mining machines. Not finding at that time on the market a machine that he considered perfectly suitable for cutting Youghiogheny coal,

he had designed a machine of the under-cutting type to suit the peculiar requirements of the case. A peculiar feature of the operation of the machine is that it advances on its own level, making a perfectly smooth floor without any off-sets, which are peculiar to some under-cutting machines. The particular advantage of this machine will be understood when it is stated that it can cut in a solid "breast" of coal without "partings," which are necessary when certain other machines are employed. The machine consists essentially of two parts, viz., a bed and a movable portion. The last-named part of the machine consists of a supporting frame, a motor, sprocket wheel, feed gearing, and a chain carrying cutting-bits. In operation the bed rests immovable upon the floor of the mine, and the portion carrying the motor and cutting chain is fed forward against the coal. The motor, running at a speed of only 150 revolutions per minute, drives the cutting chain directly through a sprocket wheel attached to the revolving field shaft. There is no immediate gearing beside the sprocket wheel between the motor shaft and the cutting chain. The manufacturers, it should be stated, call particular attention to the fact that the only gearing employed on this machine, outside of the sprocket wheel on the armature shaft, is that employed to drive the feeding nut on the screw. The motor for the Brown coal-cutting machine is a 220-volt 15-horse power machine, and weighs about 500 lbs. As before stated, it runs at only 150 revolutions per minute. This motor is of the multipolar field type, and the field revolves with its shaft in a vertical position while the armature remains stationary. The dimensions, over all, of the coal cutter, are 8 feet when the machine is closed up, or telescoped, as it were, and 30 inches in height. When the cutting mechanism is projected to the fullest extent it will make an undercut 5 feet deep by 3 feet wide by 3 inches high. As to the operation of the machine it may be said that it has been working in the mines in the Youghiogheny coal, which, next to the limestone, is extremely hard, since the 3rd of March last. Cuts by this machine are being made in this grade coal in the time of 2½ minutes per cut.

Profit sharing in the coal trade has been the subject of some newspaper discussion in the north of England lately. It has been initiated by Mr. Geo. Wm. Spence, an accountant, of Newcastle, who has had for some time under his consideration a plan for adjusting wages, which, having received the favor of many interested persons, he now places before the public. His scheme is based upon the principle that capital is entitled to receive in all states of trade some return for its employment. He therefore sets aside a part of the coal fund—that is, the money derived from the sale of coal—as interest on capital and for the return of sunk capital. Another portion is deducted for current expenses, and the remainder is taken as the fund out of which wages should be paid in a certain proportion to the other expenses, and the surplus, if any, divided between capital and labor, this surplus being distributed in the case of labor by a percentage added to the wages fund during the next period. He supposes a case. Ten per cent. is set aside as interest on capital, all the other expenses are deducted from the coal fund, and the remainder is left to meet wages and profit. There is, say, a surplus of £50,000; he divides this sum one-fourth to labor, £12,500—an addition of about 2½ per cent. to wages, and allots the other three-fourths, £37,500, to capital—equal to about 3¾ per cent. These percentages would vary, of course, with each alteration in average selling prices. In his calculations he assumes a capital of £1,000,000, and sales of 3,000,000 tons of coal, at an average price ranging from 4s. 8d. to 10s. per ton. The periods for regulating wages would be every six months. The actual net profits upon the capital employed would be treated as the average profit of the district, and if the returns were disputed by the workmen the results could be proved before any board of arbitration. Mr. Spence thinks such a system would reduce the number of strikes, if it did not prevent them altogether. In the discussion which has taken place considerable objection has been offered to the scheme. The interest on capital and the proportions in which the profits are to be divided between capital and labor are declared by one writer to be empirical. He states that Mr. Spence has neglected brains altogether—*i.e.*, the share of the management in profits whether the manager be the capitalist or his employé. A similar objection is taken by another writer signing himself "Accountant." In his letter, evidently based upon a firm knowledge of the trade, this writer points out many difficulties. He asks whether the expenditure on plant, shafts, railways, &c., would be allowed? Then he contends that the question of the capital employed would raise contention, inasmuch as many collieries have in good times wrote down the apparent capital from the profits, while others have allowed their capital to remain unreduced while all the time their leases have been running out or their mineral deposits have been diminishing. More than this, he says—and says truly—that a few years ago an average of the principal Northumberland collieries yielded a loss year by year. It would be natural, he thinks, for the owners in more prosperous years to wish to recoup themselves for the previous losses together with the interest on capital which they had not been able to obtain, and all this he imagines would lead to dissatisfaction. A county average, however, he believes is the most serious objection to the scheme. It would place the old collieries and the new, the deep and the shallow, the wet and the dry, all on one level. The profitable and the unprofitable are to be made alike, and the result would be that the poor collieries, with their distant workings, old and thin seams and expensive pumping, stand a chance of having their expenditure in wages increased because their more fortunate brethren have yielded good profits, and have, therefore, run up the average. In the opinion of this correspondent a new sliding-scale agreement is to be perferred to the scheme proposed. Mr. Spence, replying to his critics, states that the salaries of officials are included in the general expenses other than labour. Collieries losing money would be taken into account in ascertaining the average net receipts of the district, but the profit or loss of any individual colliery would not be disclosed. The whole of the acounts of any district would be, he says, condensed into one account for the purpose of settling the proportions of surplus profit to be allotted to capital and labour after payment of "all other expenses," but all the points he says are matters of detail to be considered and worked out before trying the plan he suggests.

Dr. Vortmann, in *Chemiker Zeitung*, gives a method of electrolytic separation of metals which may prove of considerable metallurgical value. According to his experiments, substances held in suspension in an electrolytic bath, such as hydrate of iron, or the sulphides of copper or lead, do not exercise any influence upon the separation of the metals dissolved in the bath; thus, nickel and cobalt could be quantitatively separated by an excess of ammonia from the solution in which iron is precipitated and held in suspension. His experiments show that zinc cannot be separated from iron in this manner, but the same result is obtained by transforming the iron into a ferrocyanide by the addition of cyanide of potash and an alkali. It was found that such a solution with an excess of alkali was not decomposed by an electric current even though this continued to act during several days. In the electrolytic estimation of zinc, cobalt and nickel, it is best to add alkaline carbonates and a little tartrate of potash to the solution. In the presence of caustic alkalies, the nickel cannot be separated in the metallic state; it remains dissolved or is precipitated as oxide or as carbonate. Upon this fact Dr. Vortmann has based a process for the separation of cobalt from nickel. In order to avoid the formation of hydroxide of cobalt at the positive pole, a small quantity of iodide of potash is added to the solution; the separation obtained is complete. Iron can be separated completely from its alkaline solution, to which tartrate of potash has been added, but, as has been remarked by Mr. Edward Smith, the metal deposited always contains a little carbon, as when iron is precipitated from a tartrated ammoniacal solution; consequently, the results obtained are a little too high, say, from 0·05 to 0·25.

The record of accidents in Canada this month is a heavy one. The fatalities include five men killed and one seriously injured by fall of roof at the Blezard nickel mine, Sudbury, Ont.; three men killed in the Pictou collieries; one man badly hurt in the asbestos country, Quebec; with several minor casualties in British Columbia. We are pleased to learn that Mr. A. Blue, Director of Mines for Ontario, is investigating the Sudbury affair. No blame is attachable to the management for the others.

Successful Excursion Meeting of the Mining Society of Nova Scotia at Londonderry.

The second Quarterly General Meeting of the Mining Society of Nova Scotia was held at Londonderry on Wednesday, 7th September. There were present: H. S. Poole, F.G.S., A.R.S.M., Acadia Coal Co., Stellarton; David McKeen, M.P., Caledonia Coal and Railway Co., Sydney, C.B.; John F. Stairs, M.P, New Glasgow Coal, Iron and Railway Co., Halifax; John E. Hardman, S.B., Oldham Gold Co., Oldham, N.S.; B. C. Wilson, Waverley, N.S.; T. R. Gue, Acadia Powder Co., Halifax; A. Kent Archibald, Dufferin Gold Co., Truro; J. R. Lithgow, Glace Bay Mining Co., Halifax; J. H. Austen, Lawrencetown Gold Co., Halifax; Capt. G. MacDuff, Waverley, representing Crawford Milling Process; G. E. Francklyn, General Mining Association, Ltd., Halifax; G. F. Moncton and T. L. Jenner, Sherbrooke; Duncan McDonald, Truro Foundry and Machine Co., Truro; D. W. Robb, Robb Engineering Co., Amherst; James Baird, Canada Coal Co., Maccan; H. P. Brummell, Geological Survey, Ottawa; W. H. Huggins, Halifax; Frank Cawley, Ingersoll Rock Drill Co., Halifax; H. M. Wylde, Secretary of the Society, Halifax, and B. T. A. Bell, Editor CANADIAN MINING REVIEW, Ottawa. The main party having arrived by the morning train from Halifax was received by the following gentlemen, composing the local reception committee: Mr. R. G. Leckie, General Manager Londonderry Iron Co., Ltd.; Mr. E. Welsh, Mr. George Ronans, Mr. W. F. Jennison, Mr. L. H. Buck, Mr. Wm. Smaill, Mr. Boutellier, Superintendent of the West Mines; Mr. F. Park, Superintendent of the East Mines, and the Rev. Dr. Walsh.

The proceedings opened at 12 o'clock in St. Bridgets's Hall, the President, Mr. H. S. Poole, being in the chair. On the platform, which had been tastefully decorated for the occasion, were seated, besides the chairman, Mr. David McKeen, M.P., and Mr. John E. Hardman, Vice-Presidents of the Association, and Mr. R. G. Leckie, General Manager of the Londonderry Iron Co., (Ltd.)

MR. E. WALSH—Mr. Chairman and members of the Mining Society of Nova Scotia: Allow me to tender you on behalf of the citizens of Londonderry, a very hearty welcome. Every one in this community is interested in the welfare of your Society, and look forward to its advancement. You have a lengthy programme to go through, so I will make my remarks short, merely bidding you all a hearty welcome to Londonderry.

THE CHAIRMAN—Mr. Walsh and gentlemen of Londonderry: I am sure that the Mining Society cannot be but deeply gratified at the reception given its members to-day, supplemented as it is by the knowledge that behind it is to come an excellent programme of instruction and entertainment. I will now call upon Mr. R. G. Leckie to read his paper, leaving the routine business of the Society to follow at a later session.

Roasting and Smelting Plant at Londonderry Iron Works.

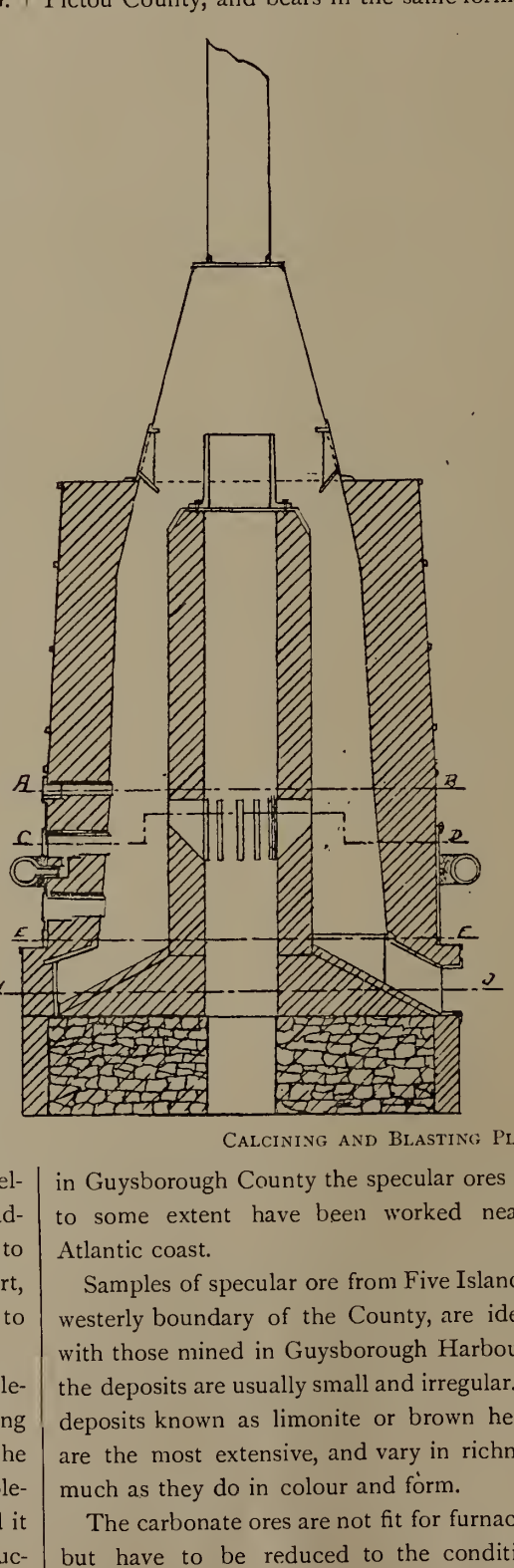
MR. R. G. LECKIE—This paper is merely a description of the plant erected here during the last two or three years. I may say the furnaces have given every satisfaction, the best average being 566 tons, of which 90 per cent was No. 1 pig: .

The ore deposits of Londonderry have been frequently described, and the paper to follow this will enter fully into their nature and composition. The oxidised ores unquestionably result from the decomposition of the carbonate ores, which form large but irregular masses in the mountain range which traverses Colchester County from west to east, continues through Pictou County, and bears in the same formation in Guysborough County the specular ores which to some extent have been worked near the Atlantic coast.

Samples of specular ore from Five Islands, the westerly boundary of the County, are identical with those mined in Guysborough Harbour, but the deposits are usually small and irregular. The deposits known as limonite or brown hematite are the most extensive, and vary in richness as much as they do in colour and form.

The carbonate ores are not fit for furnace use, but have to be reduced to the condition of oxides. Hence the attempt to accomplish to some extent in an artificial way what nature has been slowly but thoroughly doing through an unknown length of centuries.

The kilns in which the carbonate ores (a mixture of sider-opelsite and ankerite) are calcined, are a modification of the gas roasting furnace first introduced by Westmann in Sweden. Both vertical and horizontal sections are shown in accompanying drawings. The total height of kiln from floor to charging door is 28ft.; diameter at top 13 ft.; diameter at base 18 ft. In the centre is a circular brick wall 13 inches thick, enclosing an air space 36 inches in diameter. This opens at the top into the chimney and assists in drawing the gases and products of combustion, laterally through the ore by twelve ports 12″ x 2½″, situated a little above the line of gas ports. The gas ports are 16 in number, and in front are 10″ x 8″, but flare back so that in the interior there is but a point of fire brick 3″ wide separating them.



CALCINING AND BLASTING PLANT OF THE LONDONDERRY IRON CO., LTD.

This is divided by a fire-brick partition so as to give a more uniform distribution of gas and flame. The gas is admitted by a double opening in bottom of port, covered by a loose plate of cast iron, which can be readily moved so as to regulate admission of gas. Formerly gas was made in producers, but now waste gas from blast furnace is brought over in wrought iron pipes 18″ in diameter, and distributed around the kiln by a cast iron pipe, containing openings for cleaning and removing dust carried over in gas current.

The carbonate ores are used not alone for the iron contained, but also on account of their earthy constituents, which form a very desirable flux. The raw ore, when charged into the kiln,

contains on an average about 23% metallic iron, and when thoroughly calcined carries about 33% after carbonic acid (CO_2) has been expelled.

Under normal conditions, each kiln can treat daily (24 hours) 60 tons of raw ore, but over 80 tons have been put through and perfectly calcined when good gas was employed.

Two men are employed per shift on each kiln, one charging on platform and one attending to gas and drawing ore.

The ore is wheeled direct to the scales and is charged into the furnace whilst still hot.

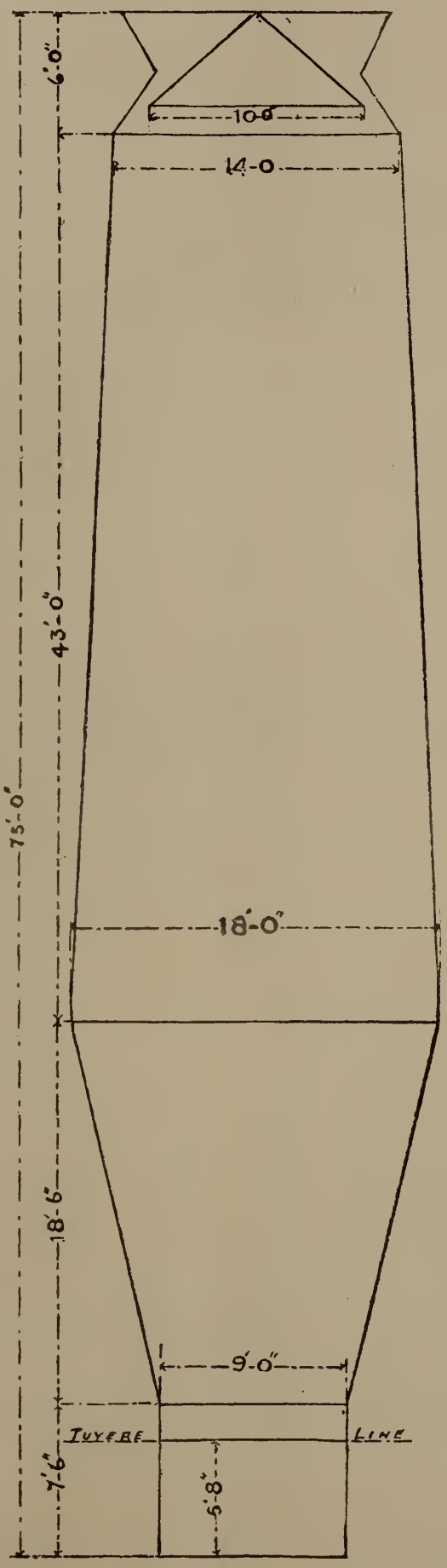
The blast furnace was rebuilt in 1890, and in April of that year was blown in. It is of the ordinary type, having a height of 75 ft.; bosh 18 ft.; diameter of hearth 9 ft.; diameter at stock line 14 ft.; and of bell, 10 ft. 6 in. It is blown with 7 tuyeres, 4½" diameter. The gas downtake is 4' 6" in diameter, and the dust catcher is a circular iron chamber 25 ft. high by 10 ft. diameter. Inside it has two diaphragms, between which the gas passes downwards and then rises up behind these diaphragms to a gas conductor which on one side leads to boilers and kilns and on the other to the hot blast stoves. The gas in its travel through the dust-catcher deposits a large amount of dust, which enables the stoves to run for nine months without cleaning, instead of for three months, as was the case before its introduction. The bell of furnace is also novel. Instead of being a plain cone, the periphery is indented—that is a space 8" wide alternates with a plate 12" wide, which enables a more regular distribution of the fine and coarse ore to be made. Although the bell is 2 ft. larger in diameter than the hopper it was put in without removing it. The bell was cast in two pieces, that is, a section was cut off by an interposed slip, and after main portion had been swung into place, the cut out portion was replaced and the two bolted together by raised flanges on upper side.

Since the introduction of this bell, the hanging and slipping which had previously given so much trouble and caused irregularity in working, ceased. The tuyeres also, which had been frequently destroyed, now give little trouble.

The removal of slag is an important item in cost, and the experiment now in operation appears to answer well. It is simply an adaptation of the tail-rope system to the slag car. Further improvements are in contemplation, which will make the discharge of slag automatic, and so reduce to a minimum the handling of slag.

Visit to the Londonderry Iron Works.

At the conclusion of his paper, Mr. Leckie invited the company to have a look round the works of the Londonderry Iron Co. On arrival, the first feature to attract attention was the new system adopted of hauling the slag to bank by tail-rope instead of by the heavy locomotive formerly employed, an improvement which effects a material saving in fuel and labor to the Company. The ore sheds with their extensive stocks of ores, red and brown hematites, from the East and West mines, and the red hematites from Torbrook in Annapolis County, were next visited; the nature and occurrence of these ores are fully described in the papers read at the meeting by Mr. R. G. E. Leckie and by-Mr. Smaill, chemist, to the company. Passing upwards, some time was spent by the visitors at the new roasting kilns, built on the West



CALCINING AND BLAST FURNACE PLANT OF THE LONDONDERRY IRON CO., LTD.

mann principle, and the features pointed out by Mr. R. G. Leckie in his paper were duly noted. The hot blast stoves, blowing engines, boiler room and casting shed were each visited in turn. Time did not permit a visit to the rolling mills and the mines.

The Luncheon.

On returning to the hall it was found that considerable trouble had been taken by the good folks of Londonderry, and particularly by the ladies, to give the visitors an agreeable surprise. The commodious room on the ground floor was found to be gaily decked out with national flags and emblems, while here and there peeping out of the bunting might be seen tastefully executed designs, reflecting sentiments suited to the occasion. The tables, profusely decorated with flowers, fairly groaned with good things provided for the entertainment of the inner man. After ample justice had been done to the collation, Mr. John Hardman, in a few well chosen remarks, conveyed to the reception committee, and more particularly to the ladies who had gone to so much trouble on their behalf, the unanimous and hearty thanks of the visiting members of the society. Mr. Walsh and Mr. R. G. Leckie suitably replied.

Afternoon Session.

Lunch over, the members returned to the hall upstairs, where Mr. William Smaill, chemist to the Londonderry Company, resumed the proceedings by reading some carefully prepared notes, descriptive of the occurrence and composition of the iron ores of the district. Mr. Smaill illustrated his subject by a very fine collection of specimens, but his remarks and the subsequent discussion are, of necessity, held over for publication in next issue.

MR. R. G. LECKIE then read the following paper by his son:—

Iron Deposits of Torbrook.

BY R. G. E. LECKIE, TORBROOK, N.S.

In bringing before you the subject of the iron deposits of Torbrook it will be as well to first give a general idea of the geological formation of the surrounding country and a rough sketch of the iron deposits of Annapolis and Kings Counties generally.

Skirting the northern edge of the counties, and forming a portion of the south shore of the Bay of Fundy, is a range of hills called the North Mountain. This range rises to a height of from four to five hundred feet above sea level, and is of Triassic trap formation. Considerable magnetic iron ore is found in this trap, occurring in parallel veins, running longitudinally with the axis of elevation and varying in thickness from six inches to four feet. Some splendid crystals of magnetite may be obtained from this locality. Unfortunately the iron veins are filled with a large number of quartz nodules, which make the ore practically valueless.

The South Mountain range is from six to eight miles south of the North Mountain and runs parallel to it. According to Dawson this latter range was caused by an upheaval of granite during the Upper Devonian period. Here we find the slates and quartzites of the lower Devonian strata, folded into synclinals and anticlinals, and finally dipping into the granite as if it had subsided, at the time of eruption, into the plastic mass. At the junction the

Devonian rocks are greatly metamorphosed. Lying between the North and South Mountains is the fertile plain which constitutes the Annapolis Valley, and down the centre of which flows the Annapolis River. Here we find a formation of recent sandstones and conglomerates, lying in horizontal beds, and resting unconformably on the trap and Devonian slates on either side.

Deposits of bog ore have been found on the surface throughout the valley, but more especially in the eastern end of it, where it lies between the South Mountain and the Annapolis River. Some leases have been taken by Americans along the South bank of the river, but as yet the deposits remain entirely undeveloped. The lower or western end of the valley is covered with marsh mud, and no bog ore so far as known has been found there.

But it is on the South Mountain, in the Devonian rocks, where lie the rich and abundant deposits of magnetite and red hematite that are destined to bring Annapolis County, some day, to be the leading iron producing district in the Province.

Beginning at the Western extremity of the County, at Clementsport, on the Moose River, is found a fossiliferous magnetic ore, which has been worked there to a considerable extent. Operations had been carried on in this locality previous to 1830, then, after a stoppage of over thirty years, were again resumed. A charcoal hot blast furnace had been erected and in the year 1862 five tons a day were being turned out. (How's Mineralogy.) The bed here is from 7 to 9 feet in width; but the ore is unsatisfactory, being high in both phosphorus and sulphur.

Thirty miles east of Moose River we come to Nictau, where several large beds of magnetic ore are exposed; east of which lies what may now be called the "Torbrook Iron Deposits." The Torbrook district may be bounded as follows: On the North, by a line running east and west, which would mark out the junction of the valley sandstones with the Devonian rocks of the South Mountain; on the East, by the Vails River, in King's County; before reaching this river, the strike of the veins have carried them out into the valley under the sandstone beds; on the South, by a line running along the summit of the mountain and marking out the junction of the Devonian and granite formations; on the West, by the Nictau River, where a large fault occurs, throwing the Devonian formation out into the valley; it has been denuded and probably underlies the valley sandstones.

The strike of the iron ore beds or veins runs diagonally across the oblong district thus indicated—the general direction being N. 60° E.

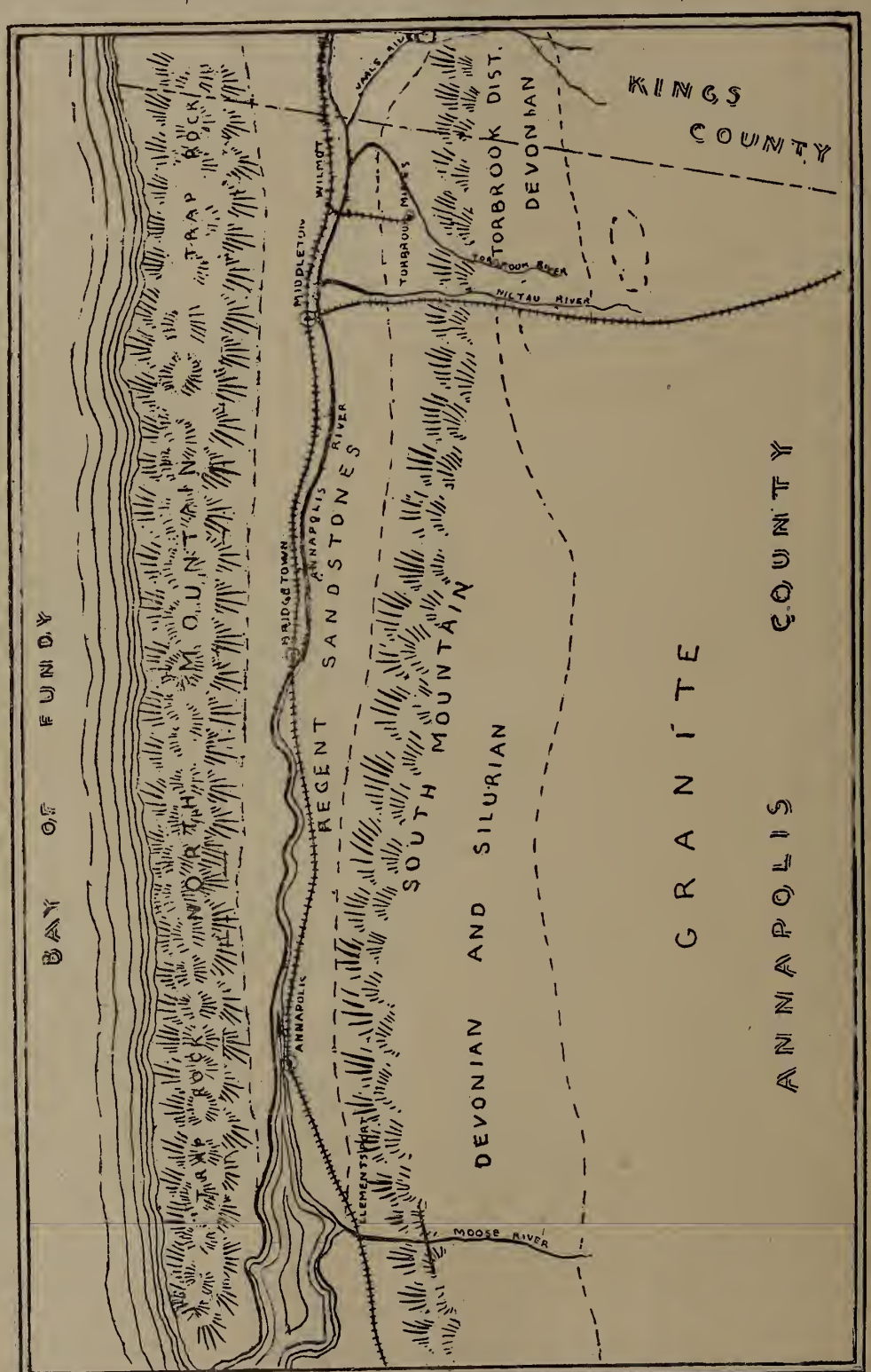


Fig. 1 GEOLOGICAL SKETCH
ANNAPOLIS COUNTY
Scale 6 miles = 1 inch

There are four known veins of red hematite, which have been traced for the most part right across the whole district, a distance of about five or six miles. For convenience sake we will number these 1, 2, 3 and 4, beginning at the North.

No. 1 vein is the most important of the four, and is the one which is being worked at the Torbrook mines. The dip is south, and varies from 70° to 80° from the vertical. The vein is very regular in width, having an average thickness of six feet. The ore is perfectly clean, there being no slate or stone between the walls. The walls are of a variegated talcose slate; white, bluish and pink in colour—the white and bluish slate predominating. There are about 18 inches of this talcose slate on the hanging wall, and two feet on the foot wall. The country rock is a harder dark blue slate, spotted with red iron stains. It is noticeable that this bed of ore is entirely free from shells, while No. 2 vein over-lying, less than 100 feet south, and several beds of the surrounding slate, are highly fossiliferous.

No. 2 vein, or the "Shell Ore" vein, as it is called, lies between 60 and 100 feet south of No. 1 vein. This was the vein that was worked by open cut for many years to supply the old furnace at Nictau Falls.

The following remarks on this bed of ore by the Rev. Dr. Robertson, a former rector of Wilmot, and an enthusiastic mineralogist, is taken from How's Mineralogy. "The vein that has hitherto been worked is situated on the east side of the River Nictau, and is intermixed to a large extent with petrified marine shells. These shells still contain their natural calcareous properties. They are very clearly marked, leaving a well defined impression in the matrix of the minutest lines. They are often found in clusters, so compact and homogeneous, that one might imagine the whole to be formed originally from one vast bed of shells. The vein is about ten feet wide, or thick, and is found to extend for some three or four miles."

Dr. Robertson is rather at fault as regards the width of the vein, it being the same width as No. 1, from 6 to 8 feet.

This "shell ore" vein may possibly be the same vein as is worked at Moose River, but the connection has not been traced, on account of the disturbed condition of the intervening ground. The shells are peculiar to the locality and have been named by Dawson the "Spirifer Nictauensis." This vein is in reality a red hematite giving a decided red streak; however, at the western end it has been slightly metamorphosed by its proximity to the igneous rock, causing it to be somewhat magnetic. How, in his Mineralogy, calls it specular ore. Specular

ore is a red hematite in composition, being the sesquioxide Fe_2O_3, and called specular on account of its structure. This has not the structure of specular ore.

No. 3 vein is about three-quarters of a mile south of No. 2, the outcrop of which appears half way up the side of the South Mountain. This vein is the same in width and structure as No. 1, the only difference being that it is somewhat magnetic in character, and has a darker streak—a reddish brown colour. The dip of this vein is almost vertical, but, if anything, dips slightly north.

It almost looks as if it were a second outcrop of No. 1 vein, on account of the similarity. It would seem as if it were the southern outcrop of a synclinal, but as yet no vein corresponding to the shell ore vein has been found north of it, without which we could hardly prove the correctness of the assumption. However, the point cannot be proved without a thorough geological survey being made of the district. The workings in the Torbrook mine are not yet deep enough to throw much light on the subject, although the dip seems to flatten a little even at the comparatively slight depth of 120 feet.

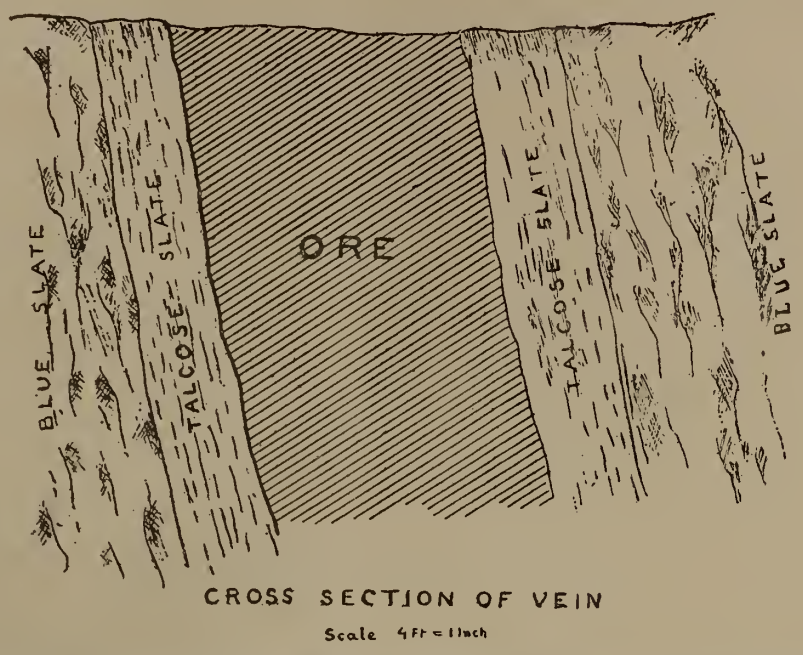
No. 4 vein in all probability lies about a quarter of a mile south again of No. 3 vein. It has been opened on Messenger's property, almost on King's County line, a distance of 2 miles east from the Torbrook mine, and following the strike, it would bring the vein much farther up the mountain than No. 3. Boulders have been found all along its probable course, which is almost conclusive evidence that it exists there. On opening up the vein it was found to be of the following dimensions :—

	Feet.
Ore	2
Slate	3
Ore	1

The walls are the same as No. 1 in composition ; being a talcose slate.

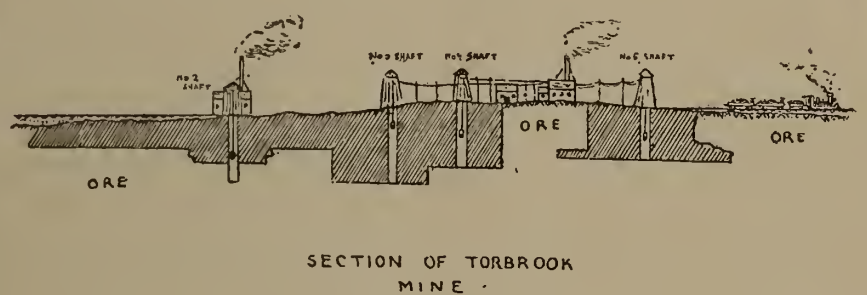
Description of Working at Torbrook Mines.

The Torbrook mine is situated at the foot of the South Mountain, 3 miles from Nictau River, and 2 from the King's-Annapolis County line. Many have confused this mine with the Nictau mine, which is on the western side of the Nictau River. The workings there are in a magnetic ore bed, 8 feet wide, which is high in both phosphorus and sulphur. Over two years ago, leases of all the available property in the Torbrook district were taken up by the Torbrook Iron Co., and work was commenced in the fall of 1890. Active operations did not, however, really begin until the spring of 1891, when steam hoisting plant was put in and ore raised from two shafts (now No. 2 and No. 4). One of these was worked by back-stoping the ore, while the other was worked "underhand." At the same time a survey was made from the mine to the Windsor and Annapolis Railway at Wilmot station, so as to connect the mine by rail. The Torbrook branch line was completed in the autumn, and immediately two more shafts were opened up (No. 3 and No. 5). No. 3 shaft worked underhand and No. 5 shaft back stoping. A four drum hoisting plant was put in during the winter of 1892 (last winter), and now does the hoisting for Nos. 3, 4 and 5 shafts. No. 2 shaft has a separate engine and boiler, it being the intention to soon hoist from that shaft with steel skips having the capacity of over a ton.



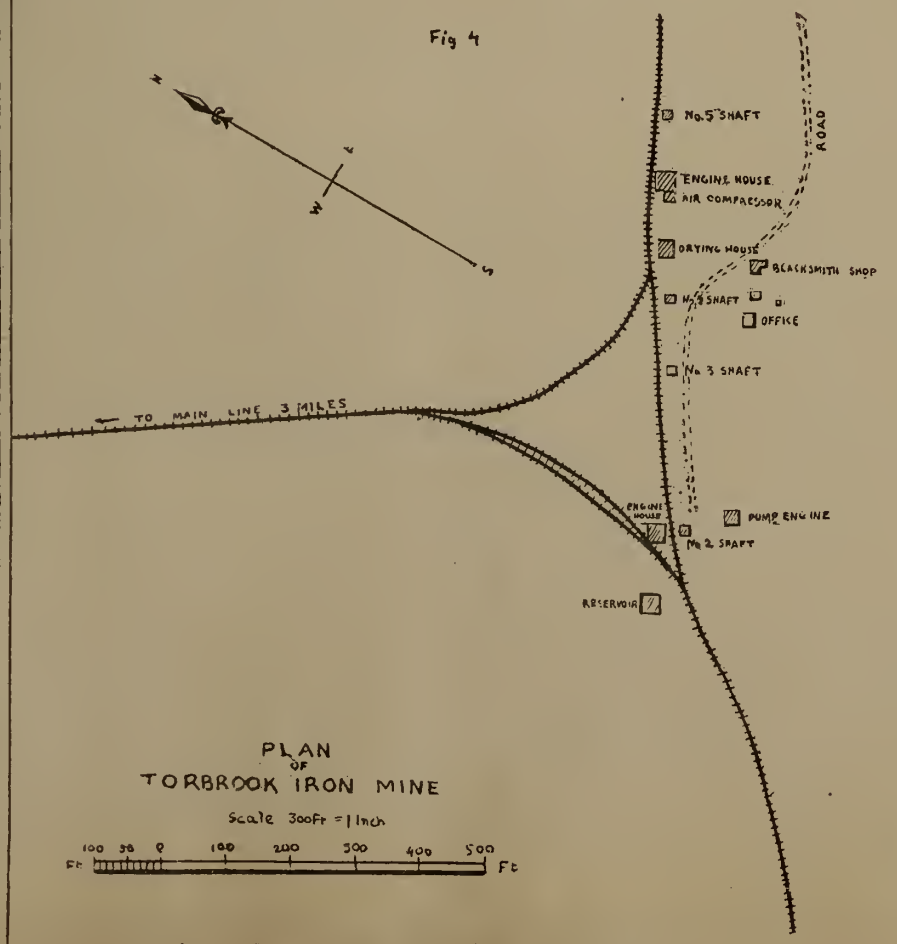
CROSS SECTION OF VEIN
Scale 4 Ft = 1 Inch

Fig. 3.



SECTION OF TORBROOK MINE
WORKED OUT PORTION THUS ////

Fig 4



PLAN OF TORBROOK IRON MINE
Scale 300 Ft = 1 Inch
100 50 0 100 200 300 400 500 Ft

The mine has lately been equipped with an air drill plant, which enables the output to be materially increased :—

	Tons per day.
Output, Spring 1891, about	20
Output, Spring 1892, about	70
Output at present	130

There is a Cornish "plunger pump" placed in No. 2 shaft. No. 4 and No. 5 shafts are kept dry by small steam "Blake" pumps.

The following are some analyses of various samples of ore, taken from the mine :

	No. 1	No. 2	No. 3
Protoxide of iron	27.09	....	....
Sesquioxide of iron	49.52	....	....
Oxide of manganese	.60	....	....
Silica	13.46	10.22	10.28
Lime	7.00	....	....
Alumina	1.90	....	....
Magnesia	1.80	....	....
Sulphur	trace	....	....
Phosphorus	trace	....	.399
Metallic iron	55.74	59.76	60.72

THE CHAIRMAN—You will all agree with me that these papers are a very valuable addition to the mining literature of Nova Scotia. At our next meeting, as is customary, members will be given an opportunity to discuss them.

MR. H. M. WYLDE, the Secretary, having read the minutes of the previous meeting, the ordinary business of the Society was taken up.

Revision of Constitution.

MR. HARDMAN said: It is the opinion of the sub-committee that the present time is not opportune for a revision of the Constitution and By-Laws, and they therefore recommend that any such be withheld for the present. They would recommend that the following lists be adopted as the classification of members and associate members. (Names submitted.)

MR. J. F. STAIRS, M.P.—The distinction seems to me to be one without any difference.

MR. B. T. A. BELL, gave notice of motion to amend Section III. of the Constitution and By-Laws, by classifying the membership into (1) Honorary Members; (2) Members; (3) Associate Members; and (4) Associates.

MR. J. H. AUSTIN moved, seconded by Mr. J. R. Lithgow: "That the report of the sub-committee be confirmed."

MR. HOWARD CLARKE—As this is not a full meeting, I would move in amendment: "That the classification of the list as reported by Mr. Hardman be deferred until another meeting." Mr. Clarke's motion not being seconded, Mr. Austin's motion was put to the meeting and adopted.

The Mining Convention in Montreal.

THE CHAIRMAN—Is there anything further to report in this matter.

MR. B. T. A. BELL—I might say that the General Mining Association of Quebec has applied for some government aid, but no reply has been received yet; there is nothing new to report. Our Association hopes to be able to submit its report to your Society sometime in October.

The Society's Transactions.

MR. B. T. A. BELL submitted in proof form a volume of the Transactions at the First Quarterly General Meeting for approval.

MR. HARDMAN—The Council has already approved of the get up of the Proceedings, as submitted by Mr. Bell; it only remains for this meeting to ratify their action.

On the motion of Mr. J. F. Stairs, M.P., the form of publication was adopted.

The Society's Seal.

The question of a seal for the Society was discussed at some length. Several sketches of designs were submitted. The matter was ultimately left for final adoption in the hands of the Chairman and Mr. Hardman.

The World's Fair.

The Secretary read the following letter from Dr. E. Gilpin, Jr., Inspector of Mines:—

NOVA SCOTIA, August 23, 1892.

H. Wylde, Esq.,
Secretary Mining Society of Nova Scotia.

DEAR SIR,—I enclose you circular *re* Chicago exhibit, and beg to draw your attention more particularly to the "gold" exhibits. As the matter is one of direct importance to your members as individuals, I feel that I may venture to address you officially. My time is so fully occupied by my dual duties of Inspector and Deputy Commissioner, that it is almost impossible for me to do justice to our minerals in this connection. Would your institute feel disposed to assist me in the collection of a good representation of gold ores. I want to show at least $10,000 worth of gold ore, and as much more as I can get.

If your Institute feels disposed to view the subject with favor, I would be pleased to give any information I have at present as to forwarding, etc.

I remain yours, etc.,
E. GILPIN,
Inspector of Mines.

On the motion of Mr. Hardman, Dr. Gilpin's letter was referred to Council.

New Members.

The following gentlemen were elected to membership: J. C. McDonald, Country Harbor, N.S.; J. W. Clendenin, New York; J. A Fraser, New Glasgow, N.S.; Frederick Taylor, Lowell, Mass.; John Daw, London, England; R. Pratt, C.E., Halifax; Dr. Falconer, Sherbrooke, N.S.; Frank Cawley, Halifax, N.S.

Report of Coal Royalty Committee.

MR. J. R. LITHGOW submitted printed copies of Petition on behalf of the Glace Bay Mining Company, to the Governor-General-in-Council. He also presented the following report of the sub-committee, which was adopted:

Report of the Committee on the proposed Memorial to the Governor-General-in-Council, asking for Disallowance of the Bill passed by the Nova Scotia Legislature increasing the Coal Royalty.

LONDONDERRY, 7th Sept., 1892.

To H. A. Budden, Esq.,
Chairman Committee on Coal Royalty.

The undersigned beg to report that early in July last they informed Mr. R. L. Borden that the Cape Breton Colliery Association and others interested, desired him, in concert with Messrs. Hugh McD. Henry and Arthur Drysdale, to draft a memorial as above.

The learned counsel named, after consultation, decided that two or three memorials would be advisable in order to more clearly present the somewhat diverse cases of the memorialists, as some of their leases or renewals contained different terms and provisions.

Herewith, we beg to submit half a dozen printed copies of a memorial received yesterday from Mr. Henry, suited, he said, for such memorialists as held renewals in which was the "increase or diminish" clause. Another form of memorial slightly different, had been determined on, but not yet printed, suited to the case of those whose leases contained the "revise and alter" clause.

The Glace Bay Mining Co's. case being different from that of other lessees, they will have a separate memorial, a draft of which is herewith submitted.

H. S. POOLE,
J. R. LITHGOW,
Committee on Memorial.

This terminated the business of the Session, and the members adjourned to the Station. While waiting for the Truro train, Mr. John F. Stairs, M.P., took occasion in a graceful speech, to return the hearty thanks of every member of the Society to Mr. Leckie and his able executive, for the exceedingly handsome manner in which they had been received and entertained. The meeting had been thoroughly successful, everyone had greatly enjoyed the outing, and he was sure they would all look forward to the time when the Society would visit Londonderry again. Mr. R. G. Leckie, and the Rev. Dr. Walsh replied. As the train steamed out of the station the members raised a hearty cheer and joined in Auld Lang Syne with great gusto. At eight o'clock the members dined together at the Prince of Wales hotel, Truro. The proceedings were of an entirely informal nature.

Dr. R. W. Ells is making an investigation of the occurrence of phosphates in Ottawa County, for the Geological Survey.

Nova Scotia Gold Yield.

Memo. showing quartz crushed and yield of gold from the following districts for the six months ended June 30th, 1892, as per returns received by the Department of Mines:—

Name.	Location.	No. of tons of Quartz Crushed.	Yield of Gold. — ozs.	dwts.	grs.
*Goldenville	Sherbrooke	201	35	14	0
Miners	"	123	22	7	10
Dufferin	Salmon River	2095	553	10	0
Oldham Mg. Co.	Oldham	1101	1460	19	12
†W. Waverley Co.	Waverley	1218	363	6	0
Moose River Co.	Caribou	804	67	17	0
*Damas Tonquoy's.	"	2361	393	17	0
Herbert Dixon's	"	370	577	10	0
Withrow's	South Uniacke	247	202	10	0
Eastville	South Uniacke	95	992	0	15
Anderson's	Lake Catcha.	297	241	19	6
New Egerton G. Mg. Co.'s	15 Mile Str'm	1400	665	0	0
Rockland	Stormont	241½	238	1	0
Copeland	"	1700½	1219	6	4
†Moose Land G.Co's	Moose Land	193	86	10	0
Malaga Mg. Co's	Malaga	754	1039	2	18
‡Boston	Malaga	757	679	1	19

The Souris Coal Field.

Mr. A. G. Yates, President of the Buffalo and Rochester Coal Company (one of the shareholders of the Dominion Coal Company), with a party of American capitalists, visited the new coal field at the Souris district, Southern Manitoba, during the month. In an interview Mr. Yates said:

"The quality of this lignite coal and the extent of its territory was a surprise. We find the seam about eight feet thick, covering a large area, and with remarkably favorable natural advantages for mining operations; there is an abundance of height or covering above the seam to assure good quality. The town of Estevan is certainly most favored, not only in these vast deposits of coal, but in having a superior quality of clay for the manufacture of brick. The best street pavements now being put down in our eastern American cities are made of hard burned vitrified brick, conceded to be more durable than asphalt or even granite block, making a smooth roadbed, not slippery, and more noiseless than any other hard material, easily taken off and renewed, and is practically indestructible. We saw samples of this clay that had been burned years ago by the lignite taking fire at the outcrop of the hills, making the best quality of brick, and demonstrating without a question the great value of this property to the City of Winnipeg as the future basis of material for the best of street pavements. The Dominion Company is developing the mine at Estevan upon the best and most approved modern plan, and arranging for a large output of coal. The burning qualities, from our observation, indicate that it is a very superior lignite, and must prove to be a great boon to this country, where fuel is so difficult to obtain, and particularly to the farming population. The town of Estevan, although less than a month old, has a large number of buildings completed, and many more under construction. The location is very picturesque, as there is an extensive view of the great Souris Valley, and we predict that with the railway advantages of the junction here, the coal, clay, and other mineral deposits necessarily making this a manufacturing and a mining town, there must follow a phenomenal growth of the town of Estevan."

Mr. Yates then introduced the scribe to Mr. Elliott, who replied to his interrogations as follows:

"As night closed upon us before we reached Estevan, I saw no evidences of coal until the end of our journey; but when morning came there was plenty to be seen for twelve to fifteen miles along the Souris river, the most marked evidences of a large deposit. This coal find is an intensely interesting one. Belonging to the tertiary age, it is an infant as compared with the great carboniferous deposits from which the immense coal supply of the civilized world is drawn. In fact this is not a true coal; it is lignite. What it may become in the far distant future can be discerned only by comparison with those fields which were deposited in the carboniferous age. But in most respects, this lignite is, for practical purposes equivalent to coal. It does not possess the high percentage of pure carbon that the famed Anthracite of Pennsylvania carries, nor the hydro carbons—volatile matter—to be found in the bituminous coals of that state and Ohio; but for all that it has less ash and waste than most of the true coal; and if the water which is held in it, in purely mechanical conditions, could be eliminated, its calorific energy would, for many purposes be equal to them. Properly cared for it should be a good domestic fuel, and no doubt is. The deposit evidently covers a large area. There are several seams, one of which is from seven to eight feet in thickness. This appears to be persistent over a large area. It is the one worked at the Hazard and also Price mines, twelve miles east of Estevan, as well as at the latter place. A careful examination at both places shows the seam to be identical and the quality to be on a par. The Estevan coal is a shade or two darker in color and hence more attractive in appearance. The Dominion Coal Company's mines at Estevan do

*Dump Slate and Quartz.
†April, May and June only.
‡January, February, March and April.

not have as much covering as at Hazard's and Price's. If this were a highly bituminous coal carrying from thirty to thirty-six per cent. of volatile as do the Pennsylvania and Ohio coals, matter which would evaporate on exposure, then the question of covering would be an important one; but it does not prevent that condition of things. Moreover, the dense impervious stratum of fine clay overlying this body of coal shuts out any possibility of the escape of any appreciable amount of valuable substance."

Underground Haulage by Electric Locomotives.*

The drawbacks of chain haulage are that: The first cost is high; they encumber the rolley-way, so that an accident may interrupt the output: and they generally require a double line of way, thus forming an obstacle to the passing of the men. Electric haulage has made great progress during the last few years. The installation is very simple: the way may be single; and, in case of breakdown the locomotive may be at once superseded by horses, kept on the spot for other work. While the electric locomotive is more economical than horse traction, it conveys the men to their working places without loss of time or fatiguing them, so that coal may be got within a considerable radius from the shaft.

A visit to the Zaukeroda Mine, in Saxony, decided M. Rambeaux, Administrateur Délégué (Managing Director) of the Marles Colliery Company, who was already favourable to the system, to make an actual trial, though on as reduced a scale as possible. The locomotive was designed by M. Neu, engineer to the Edison Company, in conjunction with the Marles engineers.

The installation is capable of supplying current to two locomotives, one only of which was made first, so as to permit of modifications, suggested by practice, being introduced into the second. Each locomotive was to exert a useful work of 10 horse power; the motor was to give out 70 per cent. of the power available on the shaft of the generating dynamo; and each locomotive was to expend 30 ampères, at a tension of 100 volts, all of which conditions were realized. The installation for haulage, and also lighting, was applied to pit No. 4, the north rolley-way of which is admirably adapted for haulage, while the conditions were unfavourable in the south rolley-way, so that a good test of the system was afforded.

The engine, with cylinder of 40 cm. (16 in.) diameter, and stroke double that figure, with expansion variable by the regulator, makes 65 revolutions and drives the dynamo by a belt, the ratio of the pulleys being 12:95, so that the dynamo makes 840 revolutions. The covered conductors, formed of copper ropes 9 mm. in diameter, are carried by porcelain insulators every 30 metres. The conductors are led to a switch board which permits of sending the current to the north and south rolley-ways, the conductors in which consist of light flange rails hung from the roof and insulated by rubber washers.

The locomotive consists of a dynamo in series, with a power of 15,000 watts, mounted on a wrought iron underframe with two axles. the motion of which it transmits by an intermediate shaft and gear, the dynamo shaft being parallel with the rails. The current is taken from the conductors by two small trucks drawn along by the locomotive; and a rheostat in the circuit, worked by hand wheel, permits a variable excitation of the magnetic field of the dynamo, so that the electromotive force and the electric power of the engine, which is well under control, may be varied at will. Two interrupters, with variable disengagement, arranged at the front and back ends, serve to close or open the circuit on the locomotive, which is also provided with reversing gear, acting by change of direction in the current. The outside length of the locomotive is 2·3 m. (under 8 ft.) width 0·72 m. (2 ft. 5 in.) and height 1·5 m (5 ft.) The weight was originally 1·8 metric ton; but, as the adhesion was insufficient on the south rolley-way, the wheels were cast full and supplemented by counter-weights, so as to bring the total weight up to 2·3 metric ton (2¼ tons).

There was no loss of current along the line. A series of careful experiments in the south rolley-way, with a gradient of 1 degree, showed the power of the electric haulage, and of the mechanical yield obtained; the results, with all corrections made, are summed up in the following table:—

No. of experiment.	No. of corves drawn.	Speed of train in metres per second.	Work in horse-power.	Useful effect, including locomotive.	Useful mechanical effect.	Commercial useful effect.	Corve metres.
				Per cent.	Per cent.		
1	0	2·50	10·86	3·06	27·	.....	....
2	15	2·38	19·33	11·3	58·5	43·38	35·7
3	15	3·46	18·21	14·	77·	54·48	41·5
4	12	2·50	17·37	10·	57·5	40·70	30·
5	4	1·49	13·96	3·37	24·07	12·46	6·
6	8	3·20	16·14	10·	61·95	38·56	25·6

The moderator limits the number of ampéres expended, but does not regulate it; in the first and fifth experiments it was kept closed, and yet the current passed from 16 to 20 ampéres. In the second and third, when it was wide open, the expenditure was the same, the difference of work done being due to the voltage. In the fourth and sixth, when it was three-quarters open, the quantity descended from 30 to 25 ampéres. The reason of this is that the electric locomotive carries its own regulator, which, for the same position of the moderator, varies the quantity of current given out in accordance with the work to be done.

From this fact may be deduced three practical hints: (1) It is important that the gradient should be uniform, so as never to exceed the number of ampéres which the rheostat is capable of supporting; (2) with too light a load the useful effect would be slight, as it is with all engines, on account of the great loss of useful work through friction and resistance; (3) a comparison of the second, third, fourth and sixth experiments shows that it is better to increase the speed rather than the load (although dead weight enters for a large part) electric engines being made for high speeds.

With respect to the third and fourth experiments, for the same number of corves drawn, on opening the moderator full instead of three-quarters, an increase of 40 per cent. in speed was obtained, while the amp-voltmeter showed an increase of only 5 per cent. The maximum useful effect was obtained in the third experiment, with twelve corves, at a speed of 3·46 m.; but, if that speed were adopted constantly, the engine might run off the rails at the points, such a speed being only practical in a straight line and with a considerable length of way. Under existing circumstances it was found best to run with the moderator open, the locomotive drawing a train of fifteen corves at a speed of 2·38 m. (7 ft. 10 in.) per second. The useful mechanical effect was 58½ per cent., which might be improved by changing the ratio of the gear, so as to maintain the same speed in the locomotive while giving the armature a higher speed, which would permit of drawing twenty corves in a train.

As regards the cost price, with fifteen corves in a gang, at a speed of 2·5 m. (over 8 ft.) per second, or 9 kiloms. (five and a-half miles) per hour, the locomotive could do a work of 243 ton-kilometres, for which four horses, with one in reserve, would be required. The two locomotives would therefore, if running constantly (a necessary condition of economical working) take the place of ten horses, though in that case it would be advisable to have a third locomotive in reserve. The installation cost:—

	Fr.
Steam engine	10,562·50
Steam pipes, fittings, erection, etc.	6,093·45
Dynamo	4,934·50
630 m. of insulated conductor	1,817·50
Erection of electric plant	3,306·31
Total for fixed plant	26,714·26
1,400 m. of electric permanent way at 5.70 fr.	7,980
Three locomotives	19,500
General total	54,194·26

The current daily expense is as follows:—

Interest on capital of 54,194·26 fr. and sinking fund, say ten years, and 300 days in the year, per day	18·06
Fuel, 2 kilogs. (4·4 lb.) per horse power per hour, say 800 kilogs. in ten hours	5
Wages—two engine drivers at 3·50 fr., two firemen at 2·50 fr., two guards at 1·50 fr., and 20 per cent. allowance for saving	18
Total	41·06

which takes the place of a daily expense for horses of:

	Fr.
Amortissement of ten horses, 200 fr. × 10 ÷ 300 days	6·66
Feed, 2·7 × 10 × 7 days ÷ 6 days	31·50
Wages—eight drivers at 3·50 fr. + 20 per cent. allowance	33·60
Total	71·76

which shows, in favour of the electric locomotives, a daily saving of 30·7 fr. (24s. 6d.) or 42½ per cent.

Per ton-kilometre the cost of haulage by locomotive is 0·084 fr., and by horses 0·148 fr. Drawing trains of twelve corves at a speed of 3·46 m. (over 11 ft.) per second, or 12½ kiloms. (7½ miles per hour, the locomotive is capable of performing a work in coal hauled of:—

$$\frac{450 \times 12 \text{ corves} \times 12{\cdot}5 \text{ kiloms.}}{2} \times 8 \text{ hours} = 270 \text{ ton-kilometres.}$$

Per ton-kilometre the cost of electric haulage will thus be $\frac{0{\cdot}084 \times 243}{270} = 0{\cdot}076$ fr., or 50 per cent. of the cost of horse transport.

In the above figures the incidental expenses connected with both locomotives and horses have been neglected, as they balance one another; but during holidays and stoppages, and especially during strikes, horse keep is a serious item, while, with electric haulage, a horse epidemic would be less disastrous in a colliery.

As regards the advantages afforded by electric haulage for conveying the men to their work, when the coal is being got at a distance of 3 kiloms. (1¼ miles) from the shaft, a man takes half an hour to go to his work, and half an hour to return.

At a speed of 9 kiloms. (5½ miles) per hour (which it is hoped will be exceeded), the 2 kiloms. will be traversed in two-ninths of an hour; for going and returning, therefore, each man will save $\frac{2}{9} \times 2$, or half an hour, and will be fresher for his work. This saving of time multiplied by 800 men, represents 400 hours or fifty days, which at the rate of 4 fr. (3s. 3d.) constitutes a daily saving of 200 fr. (£8), to which must be added an increased production of $\frac{\frac{1}{2} \text{ hour}}{8 \text{ hours}} = \frac{1}{16}$, or 6 per cent.

The conclusion the author comes to is that, in non-fiery mines, haulage by electric locomotives is commercially practical and advantageous; but great care must be bestowed on all the details of the installation.

*Abstract of paper by Clement Bailey, engineer at the Marles Collieries, read before the Charleroi Committee of the Hainaut Engineers.

The Influence of Ventilation on Explosions of Fire-damp.*

Several engineers of the Loire basin have called attention to the fact that great explosions of fire-damp have appeared to take place concurrently with a high system of ventilation. A discussion followed on the subject at the meetings of the coal industry at St. Etienne, and statistics were furnished on the accidents from fire-damp which have taken place during different periods.

Now, it should be understood that the figures shown by these statistics do not permit us to come to any absolute conclusion in reference to the subject under consideration. If from 1884 to 1891, 74 per cent. of the total number of deaths from fire-damp in France took place in the Loire basin, while an earlier period shows only 50 per cent., we may certainly conclude that the Loire basin suffers from conditions of working which are either more difficult or more defective. The question arises, however, to what causes this inferiority is to be attributed. If we believe that there is a possible agreement between the occurrence of great explosions, and thorough ventilation, we must examine the statistics from that point of view, so as to show the comparisons that may be evoked therefrom. It would be necessary in this way to consider that the explosions may be divided into two categories—the small explosions or local explosions which do not exceed, except perhaps to a small degree, the limits of a heading; and large explosions which invade the whole mine.

Now, if statistics demonstrate that before the establishment of thorough ventilation in the mines of the Loire the proportion of the number of small explosions to that of great ones was much less considerable than of recent years, it would seem that we should be justified up to a certain point in giving more extensive ventilation as the cause. And yet this would only be an indication not carrying with it any absolute certainty, for it must not be lost sight of that the evolution produced in the Loire basin during recent years has not only been in reference to improvements in ventilation. These mines work much deeper and more fiery beds than formerly. Their rate of output has also developed at the same time that their methods of working have been improved, and as the concentration of the workings became greater, this offered a larger number of victims to explosions. If, moreover, we take into account the part played in all great explosions by coaldust, it would seem to be undoubted that the actual conditions of these active and concentrated workings, augment in a large measure the danger created by the presence of this dust, which in most of the mines of the Loire, and especially in the fiery mines, is in very great abundance. Whatever may be the sum total of the causes to which these recent catastrophes may be assigned, which by repeated blows, and in an unexampled manner, have desolated the Loire basin, it does not seem that we ought systematically to shut ourselves up to one point of view, and it should therefore be interesting to search for the reasons which may be urged in favour of the concurrence upheld by some engineers.

In the first place, in the presence of the inflammable mass set in motion by the activity of the working, a mass composed in part of the fire-damp liberated in a continuous manner by the headings where the coal is hewn, or concealed in the cavities of the roof and in the timbering which supports it, and also partly of the dust which, like a fog, obscures the atmosphere of the mine, can we be surprised if an explosion, however slight it may be, should be propagated throughout the entire mine, if, when the inflammable mass is, so to speak, indefinite, the ventilation furnishes a quantity of oxygen sufficient to maintain and render active the combustion? Is it not superfluous to remark that a latent fire may become active if air be furnished, and even be disastrous under the action of a violent wind?

But it will be objected. Is it not necessary to furnish air to a fiery mine in order to drive out the gas produced, since that is the only remedy that is known? The reply to this cannot be doubtful, and no one would for an instant conceive the idea of regretting the old state of things, even while admitting that the air, more or less dioxygenised, which then reigned in the workings, was an efficacious barrier to oppose to the propagation of explosions of fire-damp. It must be remembered that the miner who worked in this atmosphere was most injuriously affected, and that in general he was reduced, about the age of forty-five years, to dragging out painfully the few remaining years left him to live. How numerous then were the obscure victims of mine working! Even if the dangers appeared to be less great, if frightful catastrophes struck public opinion more rarely, the mining population were

*Translated specially for the *Colliery Guardian* from *L'Echo des Mines et de Metallurgie.*

none the less cut off in all the vigour of life, but under conditions which escaped administrative statistics.

Good ventilation in all cases is indispensable, and it is therefore necessary that the mines should be largely and sufficiently ventilated, not only to remove the fire-damp, but also, and especially, so that the miner shall be placed in hygienic surroundings. If ventilation is indispensable to fiery mines it is no less so for others for which it would be known to possess only slight inconveniences, against which it would be easy to guard, if its intensity became a trouble or even created a peril in case of fire. But the necessity of sufficient ventilation being admitted, we must not close our eyes to the part that this ventilation may play from the point of view of propagation of explosions of fire-damp, and if it has beeen proved or only suspected that the activity of the air current has not been unconnected with the great explosions which have desolated the St. Etienne basin, the workers of fiery mines are under obligations to make fresh efforts in view of avoiding in a manner as absolute as is, humanly speaking, possible, all accumulation of gas, either by augmenting their vigilance, or by organising new means for effecting a more complete diffusion of the fire-damp in proportion to its production.

Already some have praised in this respect the secondary ventilation employed in the Blanzy mines, where its efficacy appears to be well established. Would it not be opportune to extend it to the mines of the Loire, only considerably modifying the conditions of application to the exigencies of working, which differ essentially from those of Blanzy, as much by the methods employed as by the nature of the coal and the encasing strata? Does not there arise also, in every case up to the present, the necessity of establishing in all the fiery mines a canalisation of compressed air which permits, either directly or by the intervention of mechanical arrangements, of dislodging the fire-damp from the numerous cavities which may secrete it, and which makes it possible for it to escape a diffusion, to which it always manifests an aversion?

Beside the canalisation of air, would it not be equally indispensable, or at least eminently opportune, to establish another parallel canalisation furnishing water under pressure to sprinkle the coaldust, if not continuously, at any rate at very frequent intervals, and to dislodge it, concurrently with the fire-damp, from the cavities where it tends to accumulate?

To sum up, has the improvement of the ventilation of the mines of the Loire, by the creation of rapid currents of air, exercised in recent catastrophes an influence on the propagation of explosions of fire-damp? If this question can be answered in the affirmative, or if this influence may be only suspected, then there is room for occupying oneself with devising suitable methods for augmenting the diffusion of the fire-damp by the establishment of a secondary ventilation adapted for the interior parts in which this gas liberates itself, and completing the action of what may be called the primary ventilation, which is insufficient, however excellent may be its distribution, for entirely effecting this diffusion. If finally we admit, and it appears to us to be difficult not to admit it, that coaldust plays an important part in great explosions, there is equally a need for other installations than those hitherto employed, and remaining almost entirely inefficacious, such as a canalisation of water.

Safe Blasting.

In the *Colliery Guardian* for 11th March last there was a short notice of some safety wadding for shots in dusty and fiery mines, that was reported to have been used with efficient results on the Continent, especially in the Centre district of Belgium. The wad was said to have consisted of solidified, or rather gelatinised water, the elasticity due to the gelatinous consistency permitting the wads being used in all shot holes, no matter what the diameter or inclination. It was further stated that the use of these wads permitted the men to return at once to the face, and also that they lessened the violent effect of dynamite, thus rendering its action more efficient in collieries.

This safety wadding appears to bear considerable resemhlance to the so-called gelatinous cartridge, or thickened water tamping, of Messrs. Heath and Frost, which is used with equal safety and efficiency at their colliery. This latter cartridge consists of 94 per cent. of water, with 6 per cent. of foreign matter—viz., 4 parts of soap, 1 part of starch, and 1 of glue, all three melted together. As not one of these substances is capable of extinguishing flame, the water alone is relied on for this purpose. The same result is obtained in the Continental wadding, which is stated to be water solidified, or rather gelatinized, by the addition of ½ per cent. by weight of foreign matter; and a judicious proportion of boiled glue or size would, no doubt, impart the elasticity with which the wad is credited. It is evident that in both cases water is the real extinguisher of the flame, which circumstance vividly recalls the Macnab water cartridge, introduced in 1876.

Notwithstanding the many attempts to produce a flameless explosive, this has been found practically impossible; and water, with the addition of some substance or another to give it a certain amount of consistency, is still found to be the safest and most trustworthy friend in fiery and dusty mines. In the description of the Continental wadding there has evidently been some misapprehension with regard to the water cartridge, when reference is made to the necessity for putting in the shots vertically, as if the water were to be poured in, instead of being enclosed in a case so that it may be placed in any position. Again, it is stated that the water is liable to be projected forward in a single mass; but, so far from this being the case, the latest form of Macnab cartridge, when tested in the light, and under great pressure, was seen to "sweat" just like a steam boiler subjected to great hydraulic pressure, the water in both cases exuding in the form of a thick mist. The latest form of the Macnab water-cartridge has a casing of remarkably strong and yet flexible Japanese paper which prevents the water from becoming dissipated in fissures of the rock; and this cartridge may be inserted in a hole in the roof, filling up any irregularities in the hole so as to leave no air space whatever.

Some practical experiments, or rather demonstrations, were once made with this cartridge at the Rhiwbach slate quarries, Festiniog. Ordinary shots with dynamite charges having only made a cavity—a hole filled with dust—but without cleaving the rock, a 2 inch hole was put into the slate, 8 feet deep. The last six inches was filled with dynamite, and then 18 inches of blasting powder was charged in on top of it. A 24 inch water cartridge was then inserted, and the remainder of the hole was filled up by tamping, first with clay and then with slate dust. A mass of rock weighiug 150 to 200 tons was lifted up bodily and thrown into the quarry below, the action of the dynamite, modified by the water, having cut the hard rock, which is known as "felspathic ash," in a perfectly flat plane, just as soap might be cut by a wire. This action was probably due to the enormous friction exercised by the water on the rock, wedging itself into the fissures, describing straight lines of force and preventing the tamping from being blown out.

In a recent article on the ignition of safety fuse abstracted from a paper by M. L. Janet, in the *Annales des Mines*, several methods are described for so igniting the fuse as to prevent flame from being communicated to air impregnated with fire-damp; but no mention was made of the Macnab firing tube, which has been found very handy and effectual, especially in cases where it has been desired to fire several shots simultaneously, and an electric shot-firer was not available. This little appliance consists of a brass tube about 3 inches long and $\frac{8}{10}$ in. in diameter (surrounded by tamping), having a percussion cap at the end placed deepest in the hole, with a striker, which explodes the cap on a spiral spring, stretched by a cord, being suddenly released. A slight explosion ignites the threads placed for that purpose in the powder core of the safety fuse, but is not sufficient to communicate flame through the small tube to an explosive mixture. This firing tube is used most effectually in connection with Messrs. Bickford Smith & Co.'s multiple instantaneous fuse, which is now coming so largely into use for firing several shots simultaneously.

What is now wanted in collieries is a comprehensive system of safe blasting, which shall, at the same time, bring down the coal in as large lumps as possible, while not commencing any disintegration of the substance, to be continued by primitive and barbarous loading arrangements, and thoroughly completed by the vibration to which coal is subjected during long railway journeys, considerably reducing its commercial value. When coal shall be got and raised in large lumps, and sent to its destination by cheap water instead of expensive land carriage, for which former American engineers are now casting about to find a good method of canal-boat propulsion, then will our black diamonds be delivered to the consumer with a less percentage of loss due to breakage and a less heavy charge for carriage.

Safety Lamps and Miners' Eye-Sight.

There is at last good reason to hope that the much debated question as to the cause of the disease known as miners' nystagmus will speedily and finally be settled. All who have to do with mines and mining operations know that the one great obstacle to the universal adoption of the safety lamp in mines is the scantiness of the light it affords compared with that emitted by candles, flambeaux, and other illuminants commonly used by miners. Not only are mining operations rendered more difficult by reason of the gloom it which they are performed, but—and this is the more weighty consideration—it has been stated by miners and those who profess to represent them that the strain upon the eye-sight, the constant peering through the darkness, is responsible, if not wholly at least in a great measure, for the prevalence of the occular disease already referred to, and from which so many miners suffer. Of course, such an assertion has not been allowed to pass unchallenged, and in the interest of employers no less then in the interest of the employed, searching investigations have been made from time to time, though, up to the present, opinion in favor of the theory being about evenly balanced by that which is opposed to it, the question remains undecided. Dr. J. Court, of Staveley, who, before commencing his observations, was of opinion that the injury to the eyes was caused by the position the miners had to assume in getting the coal, after the examination of 1,000 men, 500 of whom worked with naked lights and 500 with lamps, arrived at the conclusion that the lamps were at the bottom of the mischief. Quite recently he has carried out additional investigations, and in order to further elucidate the matter he has had photographs taken of the men actually engaged in the task of winning the coal. The result of Dr. Court's observations are embodied in a paper on the subject, read by him in the opthalmological section of the British Medical Association, at Nottingham, on July 28. An abstract of the paper is given below. Upon its conclusion, at the suggestion of the president, Dr. Priestley Smith, a committee was appointed to further inquire into the subject, and the outcome of its deliberations will be, we hope, the final settlement of the question if not in one direction, then in the other.

Dr. Court said the subject was one of very great interest in that locality. In the Midland district there were over 50,000 persons employed underground, and the total number of coal miners employed in Great Britain was over 500,000. If, therefore, the proportion of men suffering from that miners' disease was anything like what he had found to exist in that part of the country, a government enquiry into the subject was demanded. Referring to his report upon the prevalence of the desease among Derbyshire miners, Dr. Court said it had been urged that influence had been brought to bear upon the men, so that all whose eye-sight was affected put in an appearance, thus unduly raising the total average. To meet this objection he had taken fresh evidence. At two of the Staveley collieries he had examined the whole of the men, numbering 735, down in the pits. The coal-getters, which included stallmen, holers, loaders and headers, numbered 597, and of these 207 were affected, or 34¾ per cent., which was a higher average than was given in his report, the comparison being made with the same classes of miners. Among those who actually won the coal—the stallmen and holers—numbering 376, he found 172 cases of nystagmus, or an average of 45¾ per cent. It was a curious fact that the average in the house coal colliery was 53.37 per cent., whereas in the steam coal mine it was 34 per cent. In the soft coal holing it was in the middle, in the hard coal it was at the bottom. Those facts, he thought, more than confirmed the average got out in his previous investigations. Coming to the question of the alleged causes of the desease, Dr. Court said the evidence he produced was entirely opposed to the theory that position was the cause. The true cause of the disease was the insufficient light of the safety lamp, which required the miner to strain the eyes to peer into the darkness. The disease was rarer where the illumination was from a candle. Where a torch lamp, giving two and a quarter times the light of a candle, was used, there was no trouble at all. The light of the lamp, too, had an irritating effect, and miners carried a shield on their lamp, to shield their eyes from what they called the glare of the lamp. The bonnet and pedestal cut off a great deal of the light, and there had to be incessant accommodations of the eyes and body to the light. With candles there was no shadow. He was opposed to the theory first advocated by Dr. Dransart in France, and adopted by Dr. Snell, of Sheffield, that the position of the miner was the prime cause of the disease, and denied altogether that whilst undermining or holing the coal, the eyes were turned obliquely upwards. Dr. Snell's description of the position of the man, he contended, was not a true one. In 1890-1 he found that out of 524 men using safety lamps 164 had nystagmus, 127 night-blindness, and sixty-one photophobia, while among 573 men using naked lights only thirty-two had nystagmus, twelve night-blindness and one photophobia, and of these thirty-two men, twently-nine had previously worked with the lamps. If the position theory was the correct one, the results ought to have been the same with the candles as lamps. As to the upward and oblique direction of the eyes, he found in all the Derbyshire collieries he had been down, that when a man began to hole, the eyes were directed downwards and forwards, and he produced photographs of men actually engaged in holing. In Durham in September last, he found not a case of nystagmus among the men who had always used candles, while nearly a third of the Durham men using lamps were suffering. The Durham men, too, it was important to notice, never lay upon their sides to work, nor were their eyes ever turned obliquely upwards. Dr. Court further showed that the disease was also to be found among the men who load coal into the corves, also the deputies and others. Another strong argument against the position theory was the fact that numbers of miners had gone from safety lamp pits into pits better illuminated, and their eye-sight had improved although the occupation and the position were the same. Dr. Snell said cases of nystagmus were to be found among the men who used candles, but it must be remembered that they might have worked with lamps. Then it was urged that if a holer suffering from nystagmus changed his work he got better. That no doubt was true, but it was not the alteration of position at work that caused the improvement, but the fact that with the new occupation he had less strain upon his eyes. Stallmen and holers had less light than other men. Coming to the question of lights used in the mines, Dr. Court said the Marsaut lamp was a fair sample. It was perfectly safe, but as to the light it gave there was much to complain of. He had measured the light in a direct or horizontal line and found it to be equal to .75 of a miner's candle, which candle was only equal to ¾ of a standard candle. Then the total light of the lamps was reduced to less than half that of a miner's candle by the very large shadows cast by the bonnet and pedestal. He produced drawings which showed that the bonnet of the safety lamp cut off nearly ⅓th of the actual light given by the lamp, while the pedestal cut off still more, and in addition to this the brass pillars reduced the light another tenth. The light was lessened still more by the regulations respecting its position while the miner was at work. In naked light collieries the men could place the lights to suit their convenience. The candle did not vary in the light it gave, but a dirty safety lamp at the end of a working day gave only three-quarters of the light of a clean lamp. The result of his investigations showed that the greater the light used the less disease was to be found. In concluding this paper, the

author made some remarks upon the pathology of miner's nystagmus.

Dr. Snell, in the course of the discussion which followed, maintained that it was not the lamps but the position of the men at work that caused the trouble.

Dr. Tatham Thompson, Cardiff, said before he went to reside in South Wales he held the belief that the position was the cause of the disease, but he had opportunities of examining the Welsh miners, and further experience had convinced him that Dr. Snell's theory was not the correct one. The men in that district who worked with safety lamps never did any holing, or lay upon their sides to win the coal, and yet nystagmus was common among them. That was in the steam coal pits. On the other hand, the miners who used naked lights and worked the house coal always did holing, and lay upon their sides, but the disease was absent from among them.

Dr. Pegler, London, and formerly of Stonebroom, said he was present at some of Dr. Court's examinations, and they were strict and accurate. The results were against Dr. Snell's theory.

The president said they must look upon the disease from a wide point of view, and added that nystagmus might occur by continued effort to fix the sight under difficult conditions of light.

Breaking of a Steel Wire Rope.

M. Jacob, engineer in the French Corps des Mines, has made a communication to the *Annales des Mines* for July on the breaking of a steel wire rope on an incline at the Lavie Works, Constantine, Algeria. He opens the subject by observing that this accident brings prominently forward the rapid disorganisation of wire ropes through passing over pulleys of too small diameter, and owing to successive windings in different planes. The incline, partly underground, is 1,165 m. (1,275 yards) long, with a uniform gradient of 0·158 m. per metre (or 1 in 6.33), except near the stations, where it is 0·2 m. per metre (or 1 in 5) for a short length. It has only one line of way, of metre gauge, with pass-by for the automatic crossing of the trains, each of which consists of a truck weighing 1.4 ton, and carrying three trams, weighing together 0.52 ton, the total useful load being 1½ ton. The rope consists of a hemp core with six strands wound round it, each strand being formed of eight steel wires 1½ mm. in diameter, and of a core consisting of four iron wires 1 mm. in diameter. The diameter of the rope is 20 mm., and its weight 1·4 kilog. per metre—say 2½ lb. per yard—the indicated strength being 100 kilogs. per square millimetre (63½ tons per square inch) of steel wire. The endless rope is arranged on either side of the line of way, where it is carried by cast iron rollers. At the bottom of the incline it takes two and a-half turns round a pulley, 1·4 m. (4 ft. 7 in.) in diameter, driven by turbines with tele-dynamic transmission of power. At the top the rope passes over a pulley of the same diameter, with tension truck, the pulley being arranged in a vertical shaft with guide pulleys of 1 m. (3 ft. 3⅜ in.) in diameter. All the pulleys are of cast iron, and their grooves have no lining.

The rope broke when the two trucks fully loaded were near the pass-by. The automatic brakes did not act, and the two trucks ran down the incline. After passing the crossing point, where the gradient is 0.2 m. per metre. the first truck left the rails and ran against the mouth of the tunnel, the side frames being twisted or broken. Immediately afterwards, the second truck collided with the first and completed its destruction, the pieces being thrown to a distance of 40 m., while the rails and sleepers were torn up.

The causes to which the fracture of the rope is attributed are: Wear of and strain on the rope added to bad quality of the metal. The steel wires broke under a tensile strain of 106 kilogs. per square metre (67 tons per square inch), and also after seven double bendings in a vice, the jaws of which had rounded edges struck with 5 mm. radius, while the iron core broke under a load of 66 kilogs. per square millimetre (42 tons per square inch).

The maximum tension in a state of rest on the upper portion of the rope is 1,000 kilogs., or 1 metrical ton, being determined by the weight of the tension truck, which is 2,000 kilogs.; and the tension of the lower half of the rope is at the outside 1,000 − 540 = 460 kilogs. Now, in the state of motion, this distribution of strain is modified. Referring to a supposed diagram, let T_1 and T_1' represent the tensions on the upper and lower halves of the rope respectively, T_2 and T_2' the corresponding tensions in the other half, and R, the motive power at the rim of the pulley, representing the equivalent of the whole resistances to the motion. Then $T_1 + T_2 = 2{,}000$ kilogs., $T_1 - T_2' = R$, $T_1' + T_2' = 2{,}000 - 2\ (540 + 250) = 420$ kilogs., and $T_1' - T_2' = R$. Observation of the rope in motion shows that T_2' is very slight, whence it may be deduced that R is equal to about 400 kilogs. The greatest tension in the upper portion of the rope will therefore be 1·200 kilogs., or 14 kilogs. per square millimetre (under 9 tons per square inch), if the iron cores be left out of consideration, and 11·6 kilogs. in the contrary case, these figures being high without being exaggerated.

The turn round the pulley causes increased tension in the rope, generally represented by $E\frac{\delta}{D}$, δ being the diameter of the wire and D that of the pulley. In reality this expression represents the elastic tension of the outside fibre of a wire, of diameter δ, passing over a pulley of the diameter D, so that this formula gives, at the outside, a higher limit of the strain on the wires, and affording no very useful indication.

If a series of wires placed alongside one another in a parallel direction be taken, they will, together, have the same stiffness as a bar of the same substance similarly distributed; but if the wires be arranged spirally, the suppleness of the rope will increase as the pitch of the spirals diminishes. It seems, therefore, that the determination of the diameter of the pulleys should depend as much on the composition of the rope as on the diameter of the wires; but, as a matter of fact, it is only the latter element which is taken into consideration. The passage of ropes over the pulleys not only gives rise to a supplementary strain, but it also sets up, in a similar sectional area, an unequal distribution of the working load, which may be considered as uniformly distributed in a straight portion. This fact is due to the deformation of the spirals, the pitch of which becomes elongated on the convex portion of the rope and lessened in the concave portion; and this deformation, which is caused by the displacements of the elements of the rope, gives rise to friction and consequently to inherent wear.

At the above-named works, as the working loads of the two portions of the rope, and the conditions of their passing over the pulleys, were very different, the two portions of the rope showed a marked difference of appearance. The lower portion gave evidence of wear on the outside, appreciable, but not very pronounced. On the inside, at the first glance, the rope seemed intact; but on examining a single wire separately, small facets of wear might be observed, recurring at each spiral of the rope. These marks, as might be seen by inspection of the rope with a strand removed, were produced by the friction of the wires of one strand against those of a neighbouring strand; but in the same strand there is no sign of wear due to friction of the wires one against another. In the upper portion of the rope the outside wear is much more evident, attaining half the thickness of the wires over all the outer surface of rope, and showing that the latter were subjected to torsional movements which brought all the points in the circumference, one after the other, into contact with the pulley grooves. The internal wear, also very considerable, takes the form of transverse furroughs, due to the friction of the wires of one strand against those of the neighbouring strand, of longitudinal furroughs due to the friction, one against another, of the wires of one and the same strand; and, lastly, of a furrough resulting from the friction between the steel wires and the iron core of the strands. At these points the sectional area of the rope is much reduced, on account, first, of the wear, and secondly, of the permanent elongation of the wire, the metal of which had become brittle, while shortly before the fracture, an appreciable elongation of the rope had been noticed.

The relative displacements of the strands and the wires, on passing the upward landing, had, moreover, the effect of preventing the tar, with which the rope was often coated, from remaining attached, so that internal oxidation was very marked.

MINING NOTES.

[From our Own Correspondents.]

Nova Scotia.

Cape Breton.

Reports of the bonding of some of the leading collieries in Cape Breton are well founded. Amounts varying from $5,000 to $10,000 have been paid on options, which certainly looks as if the American syndicate meant business.

Work has continued fair during the season, and the steamers engaged in the Gulf trade are promptly loaded. Receivers at Montreal claim that receipts are 50,000 tons more than to this date last season, and are asking a halt in shipments. The new collieries, the Emery and Gardiner, are both in fair shape, and it is reported that the Low Point Company are shortly to make an opening on a recently discovered seam, said to be specially adapted for bunker. The Bridgeport area and colliery, owned by the General Mining Association, is reported sold to the International Coal Company for $100,000. The Sea Coal Bay Company are engaged in building a wharf, and expect shortly to commence shipping.

Cumberland County.

The sale of the Joggins mines is reported to some New York capitalists, and preparations are to be made for an increased output.

Work has been comparatively dull at the Springhill mines, the mildness of last winter having saved the coal stocks of the different railways. Screening and dumping at the north slope of these mines will shortly be done away with, as the boxes from it will run on self-acting inclines to and from the west slope screens.

The Cruickshank mine, two and a half miles from Maccan Station, has, it is said, a contract to supply 10,000 tons to the Government. An engine has been erected, and a large bankhead is nearly completed. Mr. Alfred Bahine, late of Maccan, is manager. Thirteen men are presently employed underground. This force will be increased immediately.

Pictou County.

Except at the Intercolonial Colliery, which is engaged in filling large orders for the Intercolonial and Grand Trunk Railways, work is very dull.

The New Glasgow Coal, Iron and Railway Company made a fine display at the recent Toronto Exhibition. The exhibit consisted of car-load of pig-iron, the first produced at the recently erected Ferrona furnace, specimens of the ores and fluxes mined on the company's property, specimens of coke made, coals from the mines in the neighborhood, etc. The other specimens consisted of products of the Steel Company's works. Immense ingots of steel, weighing over a ton each, just as they were turned out of the moulds; an immense cogging roll twenty-six inches in diameter and weighing some seven tons; steel billets rolled or hammered down from the ingot, and ready for other processes of manufacture; heavy railway and marine forgings; machinery steel in many sizes, made for many different purposes; carriage and waggon tire steel; sleigh shoes; a large assortment of shapes of sectional steel for structural purposes; angles, channels, plow beams, fish plates, etc.; mould boards, harrow teeth, hay rake teeth, harrow discs and cultivator teeth, as used in the manufacture of agricultural implements, and also a pyramid of shafting made to order for the Massey-Harris Company, Toronto, to be used in the manufacture of harvesting machinery.

At Ferrona the furnace stack is 65 feet high by 15½ feet bosh. There are three Massicks-Crookes stoves each 60 feet high by 17 feet diameter. There is a coal washing plant with storage towers, and a battery of 36 coke ovens of most modern design, said to be one of the best coking plants in America. And there are the blowing engines, the casting house, and everything else necessary for successfully carrying on the business. The steam required to drive the blowing engines and all the other machinery is generated from a battery of eight multitubular boilers fired with the waste gases from the coke ovens. The capacity of this furnace is about 30,000 tons per annum. The plant is arranged so that another furnace can be added whenever desired, the number of hot blast ovens increased, etc. In fact, everything is arranged with a view to increasing the capacity of the works. The construction of this plant was begun only in August of 1891, and the first iron was made in August, 1892.

The steel company are increasing their works by the addition of a new machine shop, 175 x 70 feet, in which some very heavy tools and machinery will be placed. Included in this will be a lathe 46 feet long with a swing of 112 inches between centres, intended for turning heavy marine work. There will also be a 24 inch slotting machine for slotting crank-shafts. A new 350 x 120 feet rolling mill is about being built in connection with the steel plant.

Killag District.

The mill of the Old Provincial Co. in this district was reported ready on Sept. 1st, but no quartz available for crushing. The Company has experienced great difficulty in getting miners to work in the new vertical shaft on account of the large amount of water flowing in between the surface and bedrock, and falling down the shaft. Mr. H. S. Mackay is the managing owner of the Company.

Goldenville.

The Alexandra property in this district has been sold to Messrs. Stuart, Hamilton, et al., for the sum of $5,000. The openings made have shown a three foot lode of quartz, supposed to run from half an ounce to one ounce of gold per ton. No other properties in the district are working, and the probabilities are that little or nothing will be done this winter.

Stormont.

The recent decision of the Privy Council, in the case of the Palgrave Gold Mining Co. vs. McMillan et al., in favor of the Palgrave Co., will lead to the re-opening of their property on Hurricane Island very shortly. Mr. H. K. Fisher, President of the Company, is now making arrangements to that effect.

The North Star Co. is to erect a ten stamp mill of old pattern near the Burke lead. Mr. Rod. McLeod, formerly of Molega and Whiteburn, is the resident manager.

The owners of the Richardson gold mine, so-called, distant about a mile and a half east of Isaacs' Harbour, have had a new road built, and contemplate the erection of a ten stamp mill of modern design. The lode, as openings on it are extended, shows a crevice about six feet in width, of which at least four feet is milling stuff. Occasional sights of coarse gold are seen; and if the rock will mill ten dollars a ton the property should become one of the largest gold producers of the province.

Country Harbour.

The Copeland mine continues to be a large producer, although the average per ton is somewhat diminished.

The McNaughten property is idle, and wages are reported in arrears.

Caribou.

The lessees of the Truro Co.'s property in this district have struck it rich, the pay chute showing specimens

which are reported equal to any ever seen there. The mill return for August was near four ounces to the ton. The Company, when it closed operations last year, under the management of Mr. Whidden, did not earn expenses.

Oldham.

Some parties from Providence, Boston, and vicinity, have bought fourteen areas on the north side of the district for $4,000. Some prospecting was done on these areas this spring by Edward Whidden (one of the vendors), and a bunch of quartz worth about an ounce to the ton was uncovered. Work on the property will be prosecuted this winter. Mr. H. F. Carpenter will be resident manager.

Montague.

"The Nova Scotia Gold Mines, Ltd.," is the modest title under which the syndicate which has purchased the Annand and other properties appears. The management are busily engaged perfecting plans for future work, and meantime are erecting some second-hand machinery taken from the syndicate's property at Waverley. Since the transfer of the property, on the first of August, the new owners have been fortunate in getting two exceptionally rich strikes of quartz, and the mine looks as well as it ever has done in the past.

The Salisbury Mining Co. will begin next month the erection of a five stamp mill. The mill will be built to accommodate ten stamps should the future working of the mine require them. The Company has three lodes opened, all showing pay ore.

South Uniacke.

The Witherow property closed down about the middle of September for an indefinite period. It is understood that this closure is due entirely to a difference of opinion among the owners regarding future policy.

The Thompson-Quirk mine reports 317½ ounces from 29 tons for August.

Darr's Hill.

The Dufferin mine reports quartz looking better than for many months. A new lode, eight inches wide, said to be worth an ounce to the ton, has been found by a cross cut in the north wall. Openings are now being made on this lode to determine its value and extent.

Quebec.

Ottawa County.

Some very fine shows of mica are uncovered at the Little Rapids mine, and a goodly quantity of excellent quality is now ready for the market. The demand for mica for electrical purposes continues to yield a good margin of profit to the operator, which greatly enhances the value of this mineral property. The phosphate uncovered continues to be of high test and plenty of it.

The British-American Phosphate Company continues to hold its place as the principal producer of this year's phosphate on the Lievres River. Manager Smith has his works in fine shape, and reports the outlook at his pit encouraging.

The Orange asbestos mine was visited dnring the month by Mr. D. A. Brown, of the H. W. Johns Manufacturing Company, Boston, and Mr. George R. Smith, of the Bells' Asbestos Company. Both gentlemen speak highly of the extent and quality of the mineral on the property.

The grinding mills at Buckingham have been treating large quantities of dump rock from the property of the Templeton Asbestos Company. The fibre extracted, though comparatively short, is of the finest quality, and Mr. Cirkel, the manager of the company, is so well pleased with the results that he will resume mining with a strong force. It is not unlikely, too, that a mill will be placed at the mine, an economy which would result in a material saving in handling alone.

The Weart plumbago mine continues to employ between twenty and thirty men. The results obtained give rise to the hope that we may see other properties in the district containing the mineral worked at an early date.

The force at the High Rock mine has been reduced to forty-five men.

The Ross Mountain and High Falls phosphate mines will, it is reported, resume active mining work shortly. Mr. Sando is back again in Canada, and talks hopefully of his project to establish super-phosphate works at Buckingham. When this company does go through it is hoped care will be taken to establish the works on a more business-like basis than that which so far has characterized the operations of the General Phosphate Corporation. With competent and energetic management, assisted by the substantial bonus given by the Dominion Government to the manufacture of fertilizers, there is a capital opening in Canada for the utilization and disposal to our own farmers of the product of our phosphate mines.

Wills vs. Stewart was up at the Aylmer Court during the month, but owing to the absence of important witnesses for the defence, the hearing was postponed to a later date.

No judgment has been given yet in the boundary suit of the Emerald Company vs. the Anglo-Continental Guano Works Company.

About 70 tons of good black mica are on the dumps of the Gemmill mine.

Eastern Townships.

The Johnsons Company has struck lately some very fine veins of unusually long fibre in their Thetford pits. Specimens shown us measured a little over four inches of fine silky quality.

The Reeds asbestos mine was closed for the season on 1st September. From four and a half months' work this year, 110 tons of the mineral, all grades, were mined, an average force of 15 men being employed. The air compressor plant put in by the Ingersoll people gave great satisfaction.

Dr. James Reed has a force of men working on contract on his Coleraine property at a point about 1,000 feet from main pits of his mine.

The H. W. Johns Company is opening Lot 20, Range A, Coleraine. An efficient plant, comprising boilers, steam drills, hoists, etc., is being put in place. Work will be carried on through the winter, under the management of Mr. James Sheridan.

All the other companies in the district, with the exception of the American Company, which is shut down, are in active operation.

Ontario.

A private letter from Rat Portage announces the sale of the Sultana mine to a company of English and American capitalists, who will put in the necessary machinery for developing and treating the output of this promising property. The price has not been made public, but it is reported that the owners have received a cash payment of $125,000. Dr. Scovil has also disposed of one of his gold properties at a handsome figure. The property is undeveloped, but the surface prospects are reported rich, and warrant the expenditure of a large sum in opening it up and testing its ores.

During the month five miners were killed and one seriously, if not fatally, injured by a cave-in at the Blezard nickel mine, operated by the Dominion Mineral Company. The coroner's inquest returned a verdict of accidental death. We hear, however, nothing of an investigation by the Provincial Mining Inspector. Surely it is full time serious matters of this kind were taken in hand by the Government in order to minimise, as far as possible, a recurrence of these unfortunately too frequent fatalities in our mining districts.

"This," says the Rat Portage *Record*, "is about the position of Rat Portage reduction works: Had the present management started out to make a muddle, it could not be more complete than now. With a big mortgage, broken machinery, incompetency and a charge of larceny against the secretary, the thing is an offence in the nostrils of the people of the district. It has proven a blight to mining operation, and a curse to our prospects for interesting capital here for some time. The *Record* has withheld adverse criticism heretofore in the hope that the position might not be as bad as was supposed, and that order might be evolved out of what appeared chaotic. But it is useless longer to overlook the facts as they were brought out at the trial on Saturday last. The concern has shown a large capacity for swallowing up money. Thousands of dollars of the people's money have gone in shares; $10,000 of a bonus has been dispelled to the winds, and those who brought thousands of dollars worth of ore to the concern have had no returns worthy the name, though there is abundant proof that the ore was of the richest kind. What the future is to bring forth is hard to predict."

British Columbia.

The Le Roi Mining Company invites tenders for sinking 120 feet of shaft on their Trail Creek property.

Some rich strikes of gold are reported in the Wild Horse district, about 60 miles west of Slocan Lake. The placer diggings are reported to have been unusually productive lately.

Reports from Kamloops announce that—Mr. W. T. Thompson, of Granite Creek, has just completed the sale to an English syndicate represented by Messrs. Attwood & Reynolds, of a group of mines, also the machinery, including a saw mill, stamp mills etc., situated at Fairhaven, in the Okanagan district, for a large amount.

The party left Penticton in the morning and arrived at Kamloops the same evening, got the necessary funds, returning the following morning, and before noon had paid over the full amount of the purchase money. It is understood that the new company will soon commence work at the mines on a large scale.

A gentleman lately returned from a trip to Yale, gives glowing accounts of the prospects on Siwash Creek and its immediate vicinity. All claims are steadily improving, and one has the pleasure of seeing as good pan-outs in the several placer clean-ups as was customarily witnessed in the palmy days. Messrs Jack Roddick and Charles Hall, of the Hall and Roddick claim, lately exhibited some unusually fine nuggets, and the Dunn claim is passing all expectation. Besides the above companies there are the Macharens, who have four men steadily employed, the Whatcom Company and Rodney. The latter company is taking out coarse silver, while the Whatcom Company have excellent quartz prospects.

The shipments of coal by water from the Port of Nanaimo for the month of August were:

New Vancouver Coal Co. ...	20,149
Wellington Coal Co. ...	12,278
East Wellington Coal Co. ...	3,435

Increased activity about the Nelson mines is noticeable of late, says the Spokane *Miner*. Work on the Grizzly Bear and Silver Queen is progressing rapidly, and a boarding house and offices for the latter are under construction. A new strike has been made south of the Silver Queen. Although the croppings were small, a large body of ore has been uncovered by stripping the lode, and in character the ore resembles that of the Silver King. The location has been christened the Anchor. The Slocan country is still absorbing much interest among mining men and prospectors. About 1,000 lbs. of ore has been shipped from the Washington, and work is being pushed. Very rich samples of dry ore have been taken from the Grand Republic at the head of Spring Creek. It is said that the ore runs very high in silver, and that a solid body has been encountered. The Blue Bird, lately purchased by John M. Burke and O. D. Garrison, is being uncovered. It is reported that several sales of properties in Jardine's camp have been made of late.

CANADIAN COMPANIES.

Creighton Gold Mining Co., Ltd.—Gives notice of application for letters patent of incorporation under the Ontario Joint Stock Companies Act. Capital, $1,000,000 in 200,000 shares of $5.00 each. The objects for which incorporation is sought are: (1) The carrying on of mining work and operations in the Township of Creighton, in the Distict of Algoma, and elsewhere in the Province of Ontario. (2) The buying, acquiring by grant from the Crown, purchase, locating, holding, alienating, or otherwise selling, leasing, exchanging, developing, and otherwise dealing in mines and minerals, and mining and other lands, claims, limits, etc. (3) The mining, smelting, treating, milling, crushing, etc., of gold, and other minerals. The first directors are: Alexander Burritt, Edward Seybold, Wm. McGillivray, M. G. Dickieson, M. C. Edey, Crawford Ross, John I. McCracken, James Davidson and W. S. Odell, all of Ottawa, Ont. The chief place of business is at Ottawa, Ont.

Beaver Oil Co.—This company applies for charter under the Ontario Companies Act. Capital, $250,000 in 5,000 shares of a value of $5.000 each. Head office: Toronto, Ont. Directors: S. M. Brookfield, Hon. S. H. Holmes, Donald J. Keith and Lawrence G. McKain, of Halifax, N.S., and Abner Nelson, Toronto, Ont. (1) Formed to buy, sell, refine, and generally deal in petroleum, paint oil, and all bye-products of petroleum, and other oils used for light and fuel. (2) To sink and work artesian wells, to procure oil, and to lay down and work pipe lines for carrying and conveying oils or other fluids, and to manufacture barrels, etc.

Toronto Chemical Smelting Co., Ltd.—Registered 31st August, 1892. Capital, $100,000 in 2,000 shares of $50.00 each. The incorporators are: A. B. English, O. B. Sheppard, C. G. Richardson, all of Toronto; T. H. Sheppard, Orillia; W. H. F. Russell, Waubaushene, Simcoe Co., Ont. Head office: Toronto, Ont. Objects: (1) To purchase and treat ores and their bye-products; (2) to smelt and refine ores; (3) to purchase patents for the purposes of the said company; (4) to purchase mining properties, and (5) to hold real estate sufficient for a place of business and for the erection of dwellings, etc.

New Toronto Oil and Natural Gas Co.—Under the provisions of the R. S. O., 1887, Chap. 157, Sec. 35, L. G. Harris, Toronto, secretary of the company, gives notice of a by-law to increase its board of directors from five to seven.

La Prairie Pressed Brick and Terra Cotta Co.—Registered 8th September, 1892. Captal, $150,000 in 1500 shares of $100. The incorporators are: Hugh Cameron, Toronto; A. D. Taylor, Montreal; Dr. T. A. Brisson, Laprairie; Wm. Johnston, Montreal; T. H. Rothwell, Goderich, Ont. Formed to manufacture bricks, tiles, and all other articles made from clay or shale. Head office: Laprairie, Que.

North America Mining Co.—Gives notice of application for charter under Quebec Companies Act. Capital, $200,000 in 2,000 shares of $100 each. Head office: Montreal, Que. Directors: Alphonse Bayard, Arthur Yale, of La Cote Visitation; F. Bayard and A. Montreuil, Montreal; G. N. Ducharme, St. Cunegonde, Montreal. Formed for the purpoie of carrying on a general mining business in the Province of Quebec.

The Pidgeon Fertilizer Co., Ltd.—Applies for charter under Nova Scotia Companies Act. Capital,

$45,000 in 450 shares of $100 each. Directors: Allen Haley, J. A. Russell, Robert Pidgeon, John E. Curren, Charles Hensley, all of Windsor, N.S. Formed to manufacture chemicals, including sulphurous and sulphuric acid, the importation of phosphate, rock, bone, nitrates and sulphates of ammonia, soda, and acids, etc., the manufacture of superphosphates and artificial fertilizers of every kind, etc.

Kamloops Coal Co.—This company has been incorporated with headquarters at Kamloops, in British Columbia, to acquire, by purchase or otherwise, coal lands and mines, and to carry on the business of miners, etc. Capital, $200,000 divided into 40,000 shares of a value of $5.00 The trustees who will manage the concerns of the company for the first three months are: Murdock J. McIver, John E. Saucier and Jean B. Latremouille. The company owns 1,850 acres of good coal lands, with two seams of coal, one 42 inches, and the other 4 feet thick, which assays 62.34 fixed carbon and 70.69 per cent. coke.

Kootenay Lake Reduction Co.—Registered 23rd August, 1892, Head office: Pilot Bay, Kootenay District, B.C. Capital, $250,000 divided into 2,500 shares of $100 each. The objects for which the company is established are: To carry on the business of mining, milling, smelting, concentrating, reducing and refining gold, silver, copper, lead ores, and other ores and minerals in all its branches at Kootenay Lake, in Kootenay mining district, in British Columbia, and in other mining districts in British Columbia and the United States, and to own, buy, sell and deal in gold, silver, copper, lead ores, and other ores and minerals, bullion and refined metals, and to purchase or hire such real estate, and to purchase, own, work and develop such mines, mining claims and mining property as may be necessary and convenient for the transaction of said business, and to buy, sell and own all such machinery, tools and other personal property as is necessary or convenient for use in said business, and to the proper promotion and management thereof.

Kootenay Mining and Smelting Co., Ltd.—Registered 23rd August, 1892. Head office: Pilot Bay, Kootenay district, B C. Authorized capital, $30,000 divided into 1200 shares of a value of $25.00 each. The objects for which the company is established are: To transact the business of mining, milling, and smelting gold, silver, copper, lead ores, and other ores and minerals in all its branches, at Kootenay Lake, in Kootenay Mining District, British Columbia, and in the Territory of Idaho, and in other mining districts of British Columbia and the United States of America; also to purchase, own, work, and develop the mines, mining claims, and mining property known as the "Blue Bell," "Silver King," "Surprise," and "Black Hawk" lodes, located at Kootenay Lake, in Kootenay Mining District, British Columbia; and to purchase, own, work, and develop other mines, mining claims, and mining property at other places; to own, buy, and sell, and deal in gold, silver, copper, lead orles, and other ores and minerals; also to obtain, buy, and own the franchise and property of the toll road from Mud Slough to a point on Kootenay River near Bonner's Ferry, Idaho Territory, and to maintain and operate the same; to buy, own, and hire steamboats, and other boats, and to operate the same for the transportation of freight and passengers; to buy, own, and hire, and lease water sites and water privileges; to buy and own, lease, and construct, and maintain buildings, roads, bridges, canals, flumes, and other water courses necessary or convenient for the prosecution of said business; to buy, and own, and hire real estate, machinery, tools, and other personal property necessary or convenient for the prosecution of said business; and generally to do all things incidental to said business, and to the proper management thereof.

Hinlota Mining Co.—This company gives notice of application for charter under the New Brunswick Companies Acts. Authorized Capital, $1,000,000 in 100,000 shares of $10 each. Head office: Lancaster, St. John County, N.B. The directors are: Herbert J. Olive, J. Herbert Wright, W. D. Baskin, Frederick R. Butcher, and Charles B. Lockhart, all of St. John, N.B. The objects for which incorporation are sought are: To purchase, own, sell, and deal in mining rights, mines and lands, mining privileges and facilities in connection therewith, minerals and milling and other plant for the extraction of metals.

Alberta Railway and Coal Co.—The annual general meeting of this company will be held on Wednesday, 26th October next, at the head office of the company in London, Eng.

Ontario Mining Convention—Programme of Proceedings at Sault Ste. Marie on 5th October.

I. To encourage the construction of colonization railways in Algoma, are you in favor of 12,800 acres, including pine and minerals per mile in alternate townships, being made to such railway companies? (12,800 acres is the area granted to the Winnipeg & Hudson Bay Railway in the North-West Territory).

II. Are you in favor of reserving the remaining townships in such railway belts with the pine and mineral for the actual settler condition upon clearing 25 acres and five years residence on each 160 acres?

III. Are you in favor of the Government retaining timber dues of $1 per thousand on all pine granted to such settler and railway companies?

IV. If the North-West Territories with a population of 70,000 and an area of 293,900 miles of prairie land will shortly be not only one province, but several provinces, should not Algoma be created into a province with its 54,000 people and 275,000 square miles, containing the gold of California, the silver of Colorado, the copper and iron of Michigan, the coal and petroleum of Pennsylvania, the Asbestos of Quebec, the pine of North America, the fertile valleys of Canada, unlimited fisheries, and the nickel of the world?

V. Are you in favor of reciprocity between Canada and the United States in all mineral and the manufactured product thereof for a term of 25 years or longer?

VI. Should the duty levied on all coke, coal and machinery used by mining and smelting companies be repaid to them?

VII. If the same protective liberal legislation had been accorded to mining interests as has been given manufacturing interests, would not Canada have reaped far greater benefits?

VIII. Should each of the judicial districts of Nipissing, Manitoulin, Algoma, Thunder Bay and Rainy River have a district council, having all the powers of a county council, with additional powers to deal with immigration and other matters, and composed of seven members, elected by the voters appearing on the Dominion list in the respective constituency, (which constituency might be fixed and changed from time to time by the judge or sheriff of the respective districts)?

IX. To induce capitalists and discourage speculators, are you in favor of granting to all municipalities in Algoma the right to exempt all improvements from taxation?

X. If Northern Michigan is entitled to three executive officers, should not one of Algoma's representatives be a member of the Ontario Cabinet as the Minister of the Department of Mines or Commissioner of Crown Lands?

XI. Are you in favor of a Dominion Mining Convention being held in the City of Montreal in the winter of 1893, and of the formation of a Dominion Mining Association at such Convention?

XII. Are you in favor of having all lands six months in arrear for taxes open to the actual explorer and settler, who would be entitled to a deed thereof upon residing thereon for six months and paying the taxes in arrear and all expenses?

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Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

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Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

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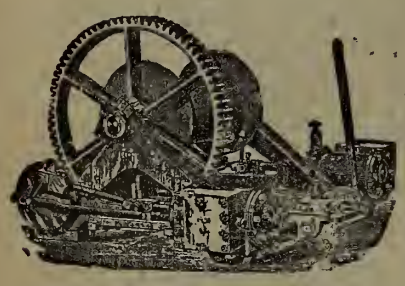

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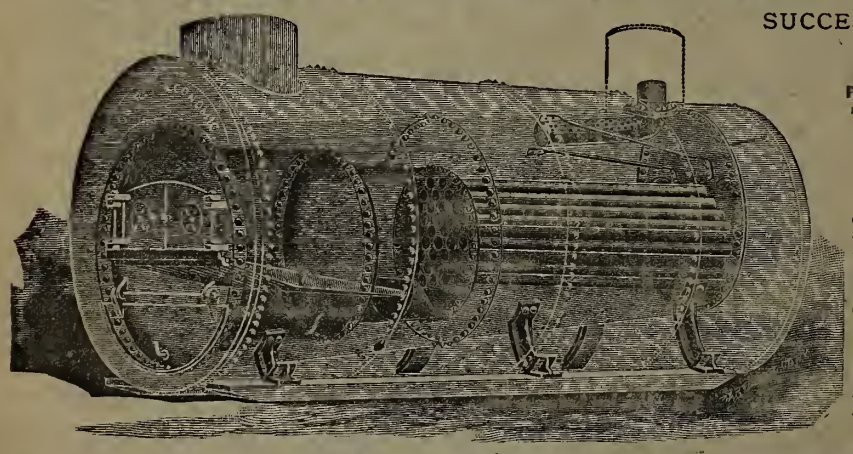

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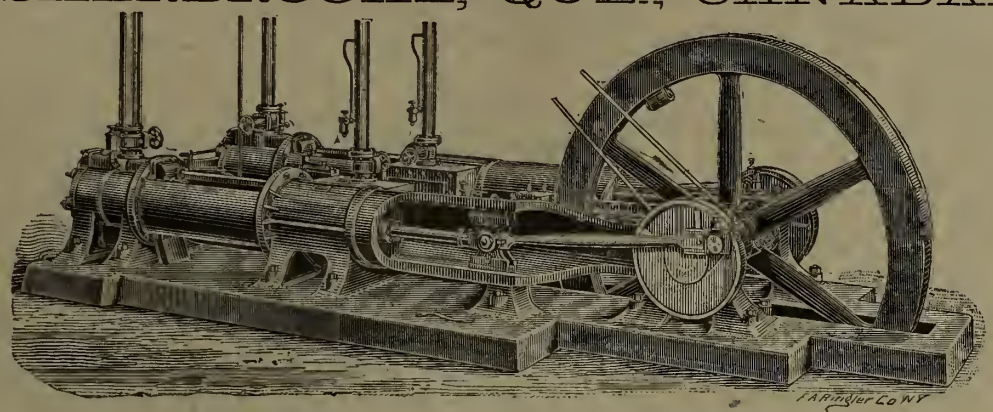

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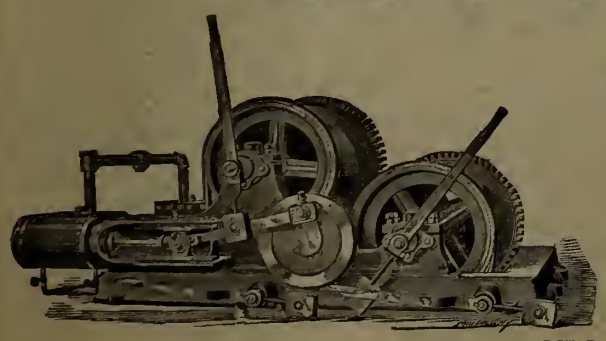

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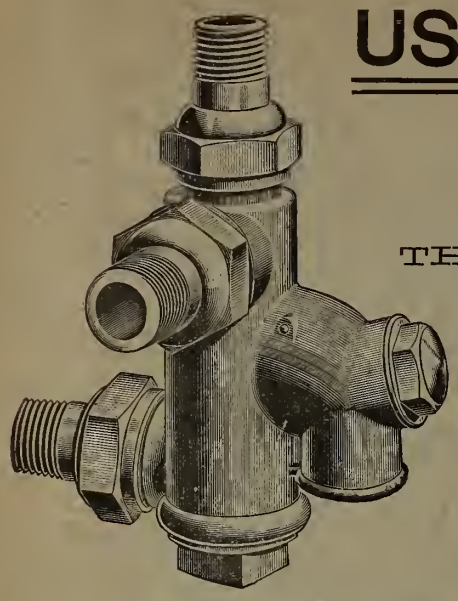

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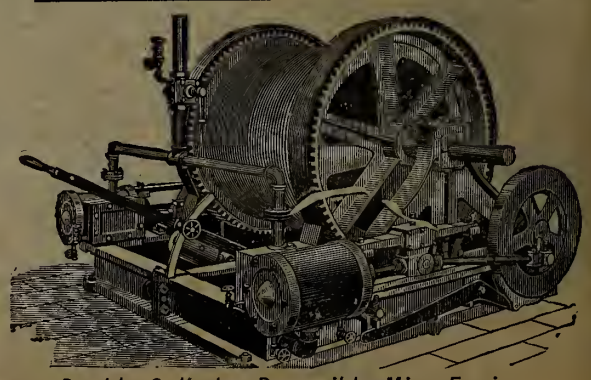

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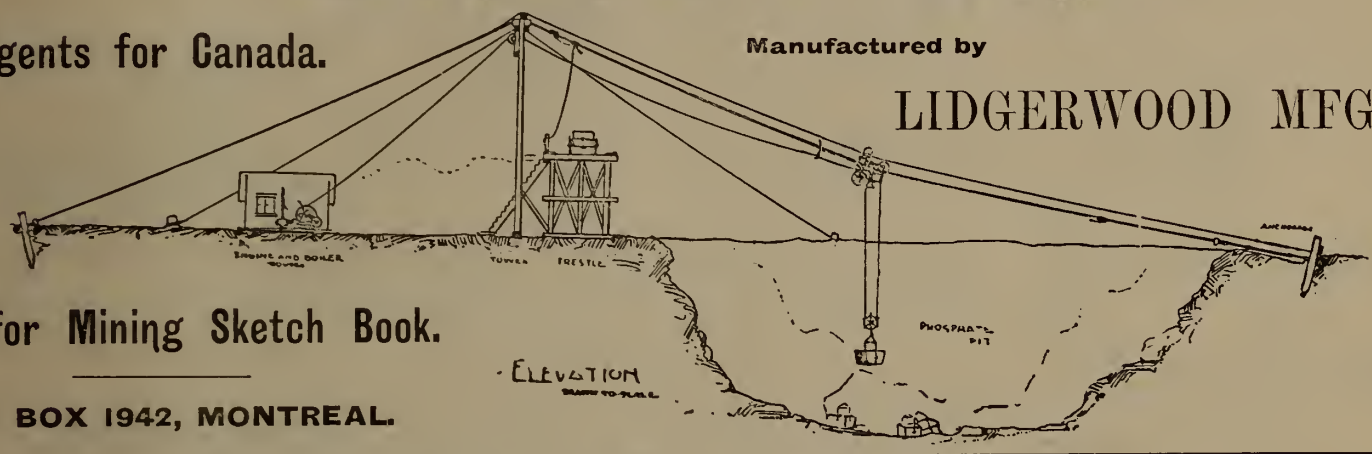

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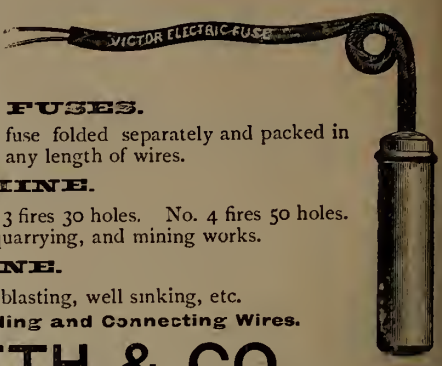

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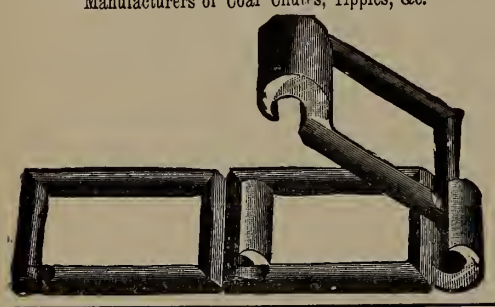

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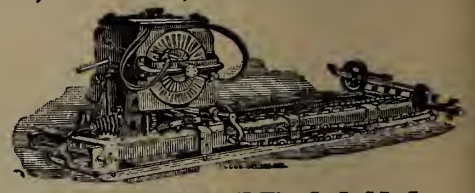

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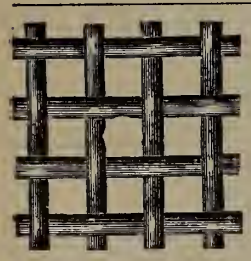

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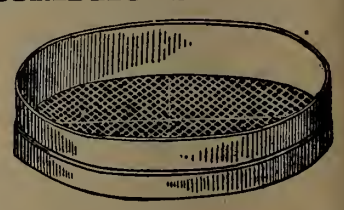

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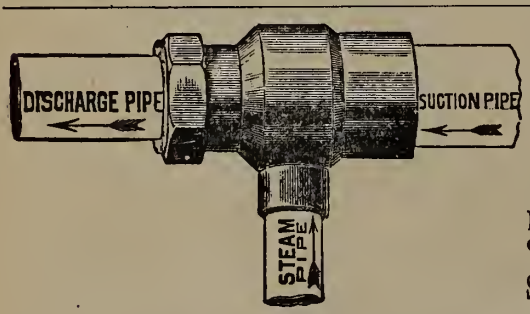

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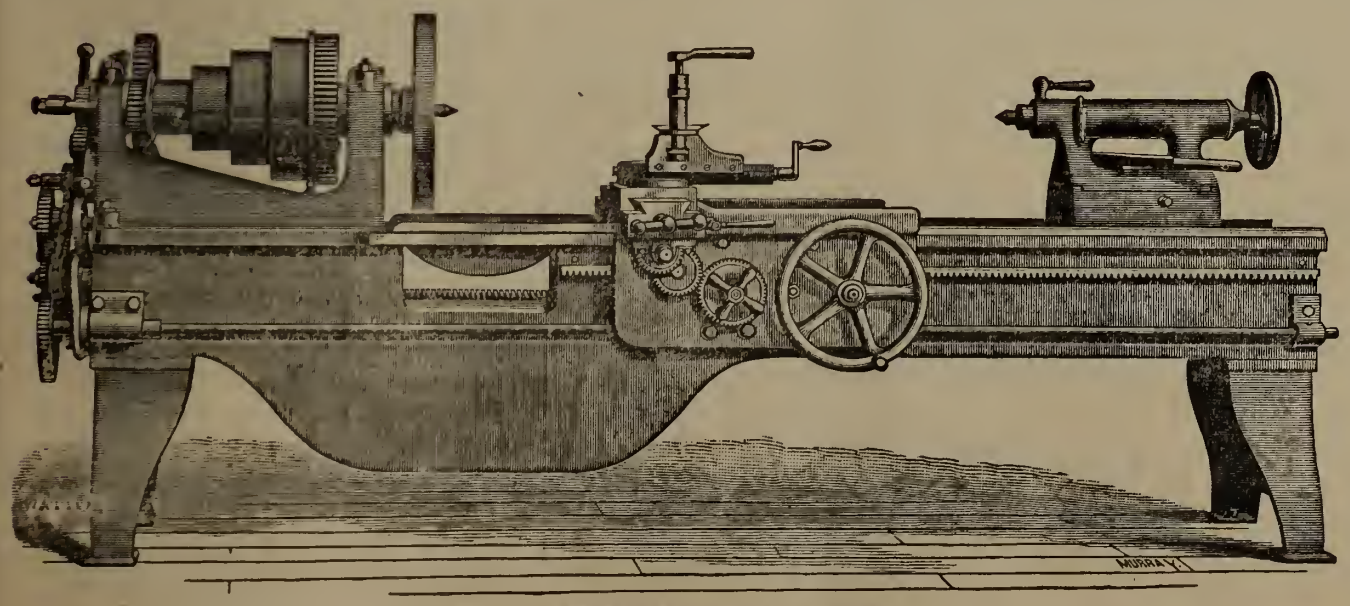

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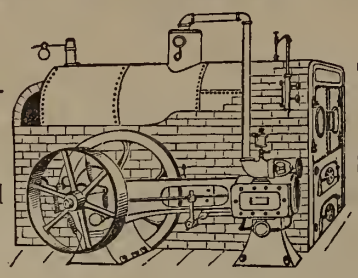

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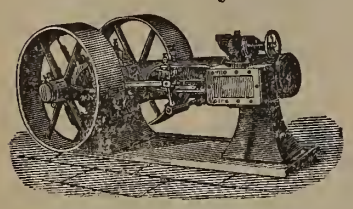

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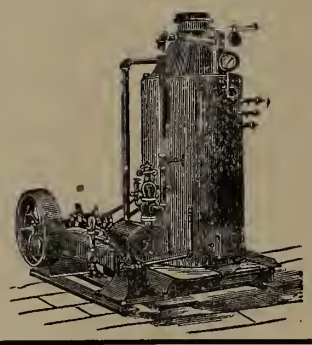

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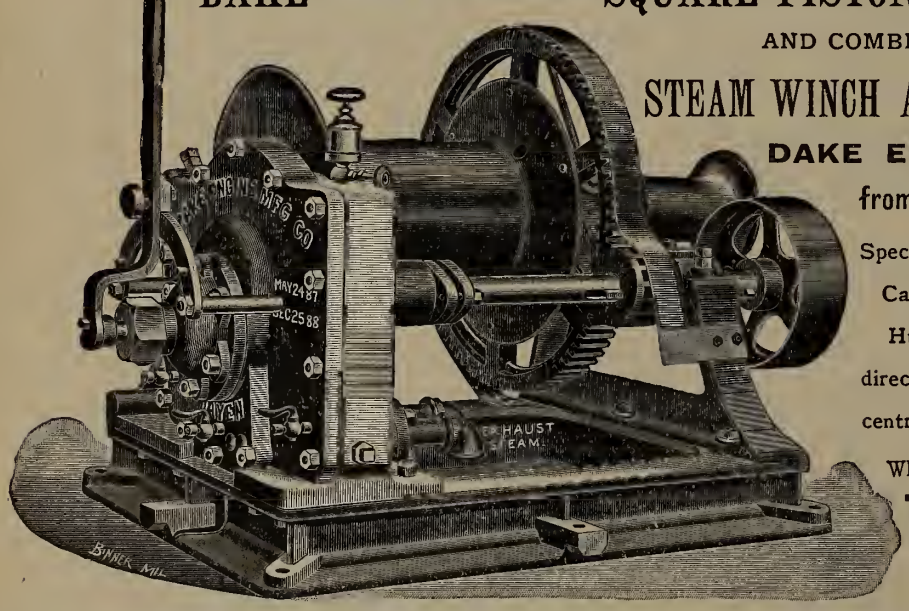

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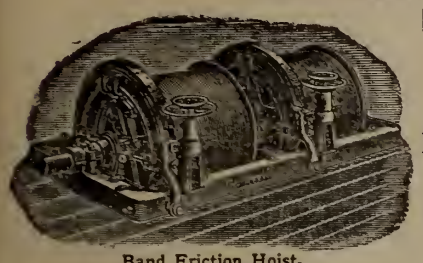

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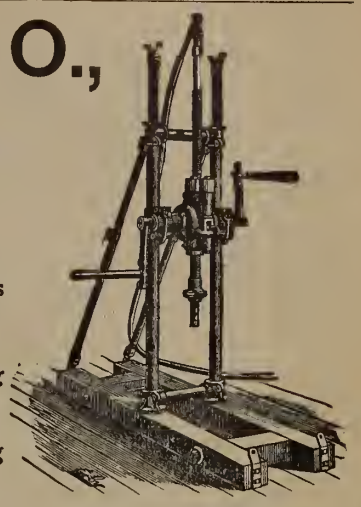

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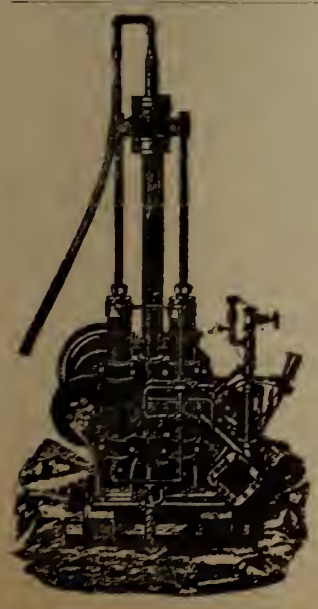

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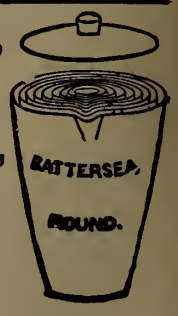

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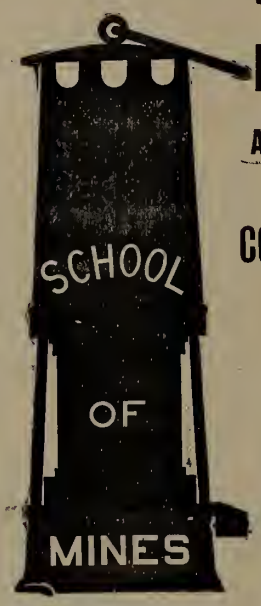

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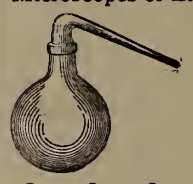

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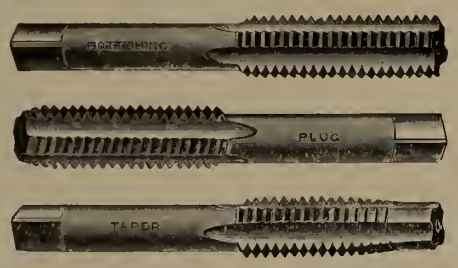

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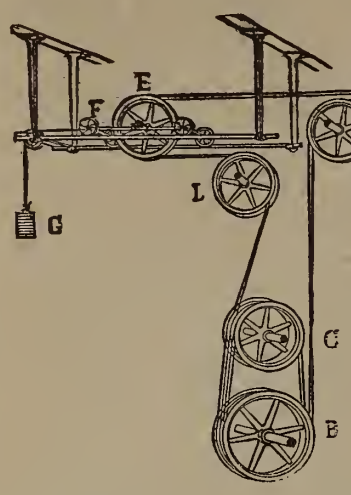

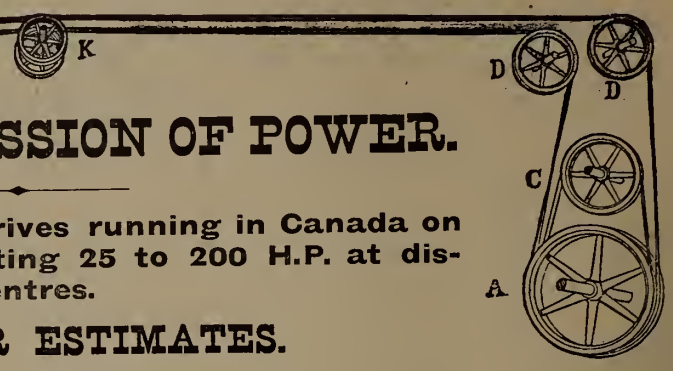

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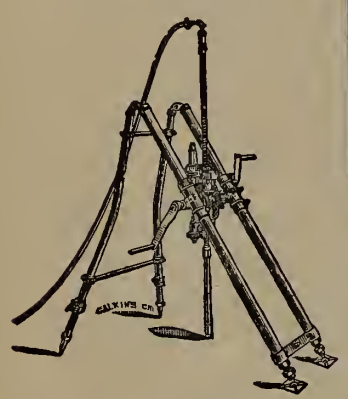

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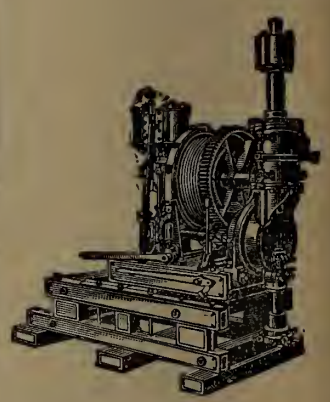

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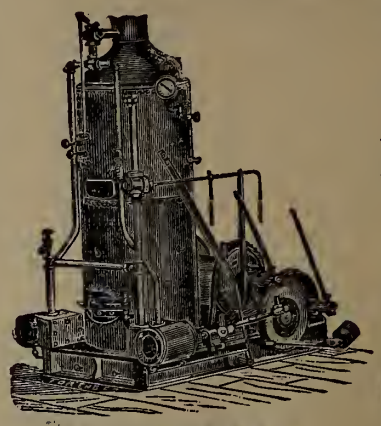

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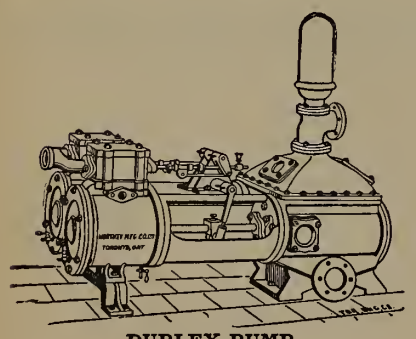

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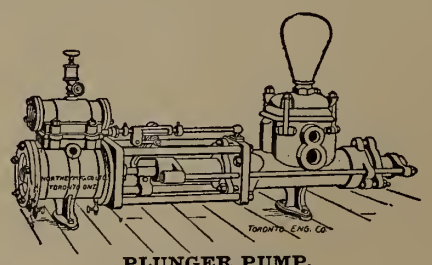

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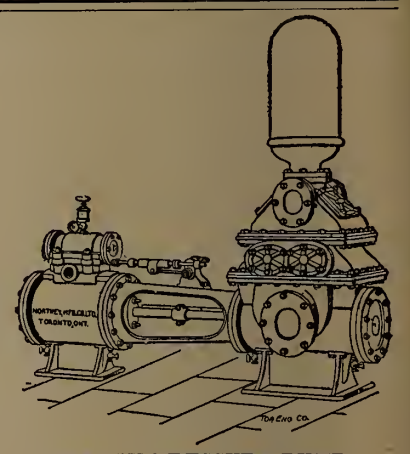

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CONDUCTED BY - - - - - - B. T. A. BELL.

THE OFFICIAL ORGAN

—OF—

THE GOLD MINER'S ASSOCIATION OF NOVA SCOTIA,

THE UNITED MINING SOCIETY OF NOVA SCOTIA,

THE ASBESTOS CLUB, QUEBEC,

THE GENERAL MINING ASSOCIATION OF QUEBEC.

THE following Resolutions of Council indicate beyond a peradventure the status of THE REVIEW as the exponent of the Canadian Mineral Industries:—

The Gold Miners' Association of Nova Scotia.

"At the annual meeting of the Gold Miners' Association of Nova Scotia, held at Halifax on 6th March, 1889, THE CANADIAN MINING REVIEW was adopted the official organ of this Association.

(Signed), B. C. WILSON, *President.*
G. J. PARTINGTON, *Secretary.*

The Mining Society of Nova Scotia.

"Moved by Mr. R. G. Leckie, seconded by Mr. C. A. Dimock, That the thanks of the Society be tendered to Mr. B. T. A. Bell for his kind offer placing the columns of THE REVIEW at the disposal of the Society; and that THE CANADIAN MINING REVIEW is hereby appointed the official organ of the Society."

(Signed), H. S. POOLE, *President,*
H. M. WYLDE, *Secretary.*

The Asbestos Club, (Quebec.)

"Resolved: That THE CANADIAN MINING REVIEW is, by authority of the Members and Council, hereby appointed the official organ of the Asbestos Club."

(Signed), D. A. BROWN, *President.*
A. M. EVANS, *Secretary.*

The General Mining Association of the Province of Quebec.

At a meeting of Council held at Montreal on Friday, 6th May, 1891, it was moved by Captain Adams, seconded by Mr. R. T. Hopper, and resolved: That THE CANADIAN MINING REVIEW be the official organ of the Association.

(Signed), GEORGE IRVINE, *President.*
B. T. A. BELL, *Secretary.*"

OFFICES:

Victoria Chambers, 140 Wellington Street, OTTAWA.

Vol. XI. OCTOBER, 1892. No. 10.

The Sydney and Louisburg Coal and Railway Company—A Word for the Shareholders.

While the list of our dividend-paying mines, asbestos, gold, coal, nickel, mica, silver, copper, and other minerals, gives abundant evidence that Canada is an excellent field for the profitable investment of capital, we occasionally have a statement that "the country is no good," dinged in our ears by English capitalists who have been soured and disappointed by ventures in profitless enterprises. Bitten once they look charily at the prospectus of any new undertaking, no matter how good, that may be promoted from this side. Yet the reason too frequently, is not far to seek. Extravagance, incapacity, ignorance, fraud, unscrupulous company promoting, particularly in London, mismanagement of various kinds, have unfortunately played their part too prominently in the history of mining by English operators in Canada. Indeed one does not wonder if the unsuspecting shareholder, trusting implicitly in his titled board of guinea pigs, and mayhap misled by the specious impositions of some incompetent or dishonest manager, should thoughtlessly seek to shoulder the blame upon and thus discredit the resources of a country about which he may, and usually does, know next to nothing.

Following up our exposé of the quackeries and frauds of Englishmen of the calibre of Dobson and Ahn, and notable failures of English corporations like the Scottish-Canadian Asbestos Co., (Ltd.), White's Asbestos, (Ltd.), and in more recent times, the General Phosphate Corporation, (Ltd.), we are compelled this month to make a disclaimer against placing to the credit of Canada, its people, and its resources, the unfortunate state of affairs presented in the last published Report of the Sydney and Louisburg Coal and Railway Company, an English organization operating in Cape Breton.

In another place a correspondent calls attention to some curious anomalies in this document worthy of attention. He points out that notwithstanding a largely increased output of coal, exceeding 170,000 tons, sold at remunerative prices, unhampered by accidents or strikes, the net profits of the company on the year's operations, or rather its available earnings not diminished by interest bonds or mortgages, amounted to the paltry sum of £1,120 stg., and having at heart the good name of the resources of the country he bluntly demands an explanation. We, too, have been curious, and as the result of a close investigation we are prompted to make the following remarks: The company was registered in 1880, to take over the property of the Cape Breton Company (Ltd). It owns and operates an area of coal lands extending over sixteen square miles, on the Island of Cape Breton, upon which are situated its Schooner Pond, Lorway and Emery collieries. The quality of its coal is excellent. Last year prices were better than they had been for many years, and for the first time in its history the company's output, amounting to 170,863 tons, surpassed the production of any of the other Cape Breton mines. Shipments were mainly to St. Lawrence ports, sales in the Province of Quebec alone reaching 92,285 tons round, and 16,934 slack coal. The net returns realized on these sales is reported to have been considerably higher than that obtained by most of its competitors. But notwithstanding these most favorable circumstances, the net profits of the company (see report of directors elsewhere) only reached the meagre, disappointing figure quoted by our correspondent.

The shareholders of the company have entrusted the care of their property to the directors. Not one of these gentlemen has ever visited Cape Breton, though the company began business there in 1881, since which date fully $30,000 must have been paid by the shareholders in directors' fees. Had the chairman known more of Sydney, it would have been impossible for him to stand up in London and say that an "impact with ice" in April, 1891, injured the company's pier, necessitating repairs at a cost of £1,328. No such damage, as far as we can learn, occurred within the knowledge of any reputable resident of Cape Breton, and no repairs of such cost were made.

So much for what the chairman would not have said. On the other hand, had he been properly in touch with the property whose development he presides over, or did he and his co-directors follow the example of their neighbours, the General Mining Association, a company similarly situated in every respect, in sending out a trusted representative each year to look into matters on this side, he would have been able to tell the shareholders, while explaining to them the necessity of paying a £600 instalment on the purchase of their new coal area, that this same area was sold to the company through a third party by three of its servants, who realized £3,000 for what had only cost them a short time before, the amount of fees payable to the Mines Department in Halifax. And while on this subject it might also have interested the shareholders to learn that these same three servants have plastered the surrounding country with "licenses to search," in the hope, it is to be presumed, of making yet another such a lucky scoop.

Had the chairman, knowing this, failed to fully explain the transaction to the shareholders, he would have failed in his duty to them, inasmuch as the sale of areas for a large sum to the company by a syndicate composed of its mine manager, its accountant, and its head engineer, could only be justified by special circumstances and certainly not without proof, based on an expert's examination and report, that the company was getting good value for its money.

Again, had the chairman been adequately posted as to what was being done across the ocean, he would or should have told the shareholders of the erection of large buildings and warehouses on the company's property adjoining their pier, and explained how these same buildings with adjacent wharves and premises, also belonging to the company, came into the possession of "J. Webb & Co."

There probably would be nothing in such intelligence to excite suspicion, unless the chairman proceeded to state that this firm of "J. Webb & Co." is generally regarded to be a myth, as can be learnt from any Mercantile Agency, and that the name is simply used as a cloak by the company's agent and manager, who, under it, carries on a large wholesale and retail business, numbering among his customers the company whose interest he is paid to protect.

These questions having been disposed of, it would be in order for a suspicious or dissatisfied shareholder to enquire why the toll levied on the proprietor of the mines store for stopping in the office on orders, moneys due to the store by the company's workmen, is not paid into the company's coffers, seeing that the work in connection therewith is performed altogether by the company's servants, and why the manager is permitted to pocket from this source a large annual income (sufficient last year, had it gone to the company, to have increased the divisible profits by more than one-third), paying only a small, if any, proportion to the company.

By this time the disgruntled shareholder would feel inclined to ask the chairman how much was spent in 1891 upon the manager's house, of which mention was made and a photograph exhibited at the previous annual meeting,

and why the directors thought fit to spend on a palatial residence, which overtops in magnificence anything ever attempted by the most optimistic company in Nova Scotia even during the old regime of princely extravagance, an amount that would have almost sufficed to pay off a year's arrears of interest on the preference shares.

But so long as things remain as at present, the chairman is not likely to volunteer any such information at shareholders' meetings, and the latter, being told and believing that their interests are faithfully and economically looked after, will curse the country they have invested their money in, instead of laying the blame upon the proper shoulders.

EN PASSANT.

It is now a certainty that the proposed International Mining Convention will take place. Among others who have accepted an invitation to be present and take part in the proceedings may be mentioned the American Institute of Mining Engineers, the Mining Society of Nova Scotia, the General Mining Association of Quebec, the Asbestos Club, and the Provincial Mining Association of Ontario. The proceedings, which will occupy the greater portion of the third week in February next, will take place in buildings of McGill University, Montreal. The subjects to be discussed will be divided into the following heads: (1) Mining Legislation, having particular reference to the laws of the various provinces of Canada; (2) Our Mineral Resources and Mining Industries; and (3) Canadian Mining Practice. The Convention will be held under the auspices of the General Mining Association of the Province of Quebec, by whom it is understood a liberal programme for the reception and entertainment of visitors is being prepared.

This will be the fourth occasion on which the American Institute has held meetings in Canada, sessions having been held in Montreal, at Halifax, and in Ottawa in 1889.

Just as we go to press we are in receipt of the First Annual Report of the Bureau of Mines for the Province of Ontario. Mr. Archibald Blue, the Director, has done his work thoroughly, with the result that an immense amount of useful information respecting the minerals and mining development of the Province is given to the public. The Report covers nearly three hundred pages, closely printed, neatly gotten up, and well indexed for reference. Among other features of interest may be noticed a review of the operations of the Ontario Mining Act, to which is appended interesting extracts from the report of the British Commission on Mining Royalties, a sketch of the artesian wells in the Province, a paper by Dr. Robert Bell on the Laurentian and Huronian systems north of Lake Huron, in which is incorporated much useful data respecting the mineral wealth of that portion of this country, a review of the production of structural materials, an extended notice of the resources of Ontario in natural gas and oil, a well timed and exhaustive article on the subject of "Peat, its use and value for fuel," the whole concluding with the report of Mr. Slaght, the Inspector of Mines, in which he gives his observations on the progress made in the different mining camps during the year 1891. The report is a valuable acquisition to the mining literature of the country.

At the last spring meeting of the Iron and Steel Institute, Mr. Arthur Wingham read a paper descriptive of a new slide-rule. The calculations necessary for the preparation and control of furnace charges and material are often long and tedious, and, moreover, frequently require a ready knowledge of chemical formulæ or equations and atomic weights. It is well understood and recognised in works that any means which will shorten the time and trouble bestowed upon such calculations should be encouraged and valued as so much gained. The present slide-rule has been constructed for the purpose of giving immediate, and, at the same time, accurate results. It can be applied to and utilized in various manufactories, but it will probably be found to be most useful in iron and steel works. The principle on which the slide-rule is constructed is that of having a scale for each base, basic material and acid, so divided that any given length or quantity of one will show in the same length of the other the quantity of material which will be necessary either to displace or combine with it, as the case may be. These scales are placed side by side in such a position on the rule that the rectangular end of the slide above them measures the amounts of each material, which chemically correspond one to the other. The practical use of the scales is further enhanced by the peculiar construction of the rule. It consists of a framework or body about 12 inches long, 1¾ inches wide, and ¼ inch deep, into a broad shallow cutting near the surface of which slides to within an inch of end a long rectangular slip of wood, which may be designated the main slide. In the body underneath this main slide are four narrow slides, which are moved by prominences which reach beyond the surface of the main slide at one end. These under-slides can only be moved when the main slide is out, and the closing of the latter shuts up all the former. On each of these four under-slides is marked one of the following basic scales: Magnesia, alumina, soda and ferrous oxide (manganous oxide is practically the same as ferrous oxide). The lime scale is marked upon the lower surface of the body, close to the silica scale. Among the chief recommendations of the rule is the fact that it contains a large amount of information in a very small space, and in a form by which are given results sufficiently accurate for practical purposes. These results can be obtained in a very short space of time, without the probability of that inaccuracy which is so often attendant upon rapidly made calculations. The manufacture of the slide-rule has been entrusted to Messrs. John Davis and Son, of Derby, England.

It is stated that Mr. E. M. Smith, of New Zealand, has been conducting some further experiments regarding his process for smelting ironsand, in the course of which a blast furnace at Onehunga was charged with the ironsand in the shape of bricks instead of with iron ore. A tapping took place, and the result was that several tons of iron were obtained from the surface. The metal was pronounced by experts to be workable iron of first-class quality, far superior in fact to that hitherto produced from any of the New Zealand ores. A portion of the molten metal was converted into small castings, amongst which was a barrow wheel, and it stood this test in a highly satisfactory manner. The "bricks" with which the furnace was charged consist of an admixture of ironsand and clay, and were brought by Mr. Smith from New Plymouth, where it was manufactured fifteen or sixteen years ago. A further quantity, made of similar materials, has just been brought to Onehunga from the Avondale Brick Works, and is now being used to feed the furnace. Mr. Smith claims that the yield of iron is equal to 50 per cent. of the weight of the bricks, and he is sanguine of being able to produce iron of a high class at a payable rate. Coke from the grey coal was used in the trials, and there being at the time a scarcity of limestone at the works, shells were used in its stead. Two truckloads of Kamo limestone have, however, recently come to hand, and will be used in future operations. The trials have been watched with great interest by the Onehunga people, to whom the development of the industry is of much importance, as it is said the west coast abounds with inexhaustible quantities of raw material in the shape of the deposits of ironsand.

An important trial of ammonite, the new explosive, took place at Newport, Monmouthshire, lately, in blowing down a heavy stone wall of 920 cubic yards capacity dividing the Alexandria Dock from an extension dock which had just been completed. Water had been let into the new dock from the River Usk, and a level made with the water in the older dock. In order to remove the wall dividing the two, it was decided to try the explosive force of ammonite fused by electricity. Charges of 100 pounds of the compound were placed in 43 drilled holes, and a dynamo at 110 volts was connected with the charges. Lord Tredegar, as chairman of the dock company, moved the electric switch, and the explosion that followed was considered highly satisfactory. It was not intended to demolish the wall entirely, but to so split and crack it that the masonry could be easily dislodged and removed. That result was practically attained, the wall being loosened all through from top to bottom without any damage being done to the surrounding works at the dock. Ammonite is one of the Sprengel class of explosives. It consists of ammonium, nitrate, and nitro napthalene, mixed together in an edge runner rill at a certain temperature, and afterwards filled into metallic cases. One of its chief advantages is that for many purposes it is

perfectly harmless, and cannot be fired by ordinary concussion, or even by throwing it into an open fire. Its explosive properties are only brought out with the aid of a detonator containing fulminate of mercury.

Among the many yarns that crop up in the mining literature of our friends across the border, the following, clipped from a western contemporary, may be taken with the proverbial grain of salt: A trick was successfully played upon a party of San Francisco men in 1861 by some Silver City miners who were prospecting a vein of gold-bearing quartz. The vein was very "spotted," and the pockets, when found, were small. The miners had a shaft down about 25 feet on their vein, and having reached a rich pocket that covered the whole bottom, were anxious to sell, as they might sink 50 feet further without finding another spot as rich. In Virginia City they found three men of money from San Francisco who wished to invest in a mine, and who were well pleased with the samples of ore shown them. The San Franciscans agreed to go to Silver City in a few days and examine the mine, when, if they found all satisfactory, they would pay the price asked—$20,000. With the San Francisco trio was a fourth man who was impecunious, but not contentedly so. This man "approached" the miners on the sly, and saying he had great influence, offered to talk the San Francisco men into buying the mine, provided he were given a share of the spoils. It was agreed that he should have $500 if the sale were made. Then it was arranged that on a certain day the Silver City men would not go near their mine, that they should be at work at another place a mile away, On that day their confederate was to take his friends, the San Francisco capitalists, to the mine on the sly and assist them in prospecting the bottom of the shaft in the most thorough manner; he telling them he had ascertained that the owners would be at work on another claim for a day or two. The three San Franciscans bit at once. They thought it would be a clever trick to steal a march on the "honest miners." They dug into all parts of the bottom of the shaft and obtained wonderful prospects. Free gold was visible in almost every piece of quartz they dug out. In short, they readily paid the $20,000 asked for the mine and set to work in the shaft expecting to get their money back in less than a month. They had not got down over two feet, however, before they were in barren quartz. They did much work, but never found anything except a few insignificant pockets. The worst of it was that they dare not complain of their bad luck, for as soon as they had secured the mine they had boasted to many friends of the cunning way in which they had prospected the bottom of the shaft. It was long before they heard the last of their mining venture. When they talked of there being a big thing in a mine their friends would ask them if they had been prospecting it "on the sly." The $500 which their honest friend had received changed his luck; he remained in the country and presently secured a fat State office.

Notes from Laboratory on Some Iron Ores from Nova Scotia.*

Wm. Smaill, Londonderry, N.S.

Glancing at a map upon which the occurrence of different minerals of this Province are marked, one will notice that the main deposits of iron ores seem to be confined to a band about twenty miles wide inland from the Bay of Fundy, starting in at Digby and continuing in a north-easterly direction to Colchester County; here taking a more easterly course through Colchester, Pictou, and Antigonish Counties, when it again resumes its northerly course through the central parts of Cape Breton, and are found in rocks of the Triassic, Carboniferous, Devonian, Silurian, and Laurentian.

Naturally, the different chemical and mechanical processes—giving rise, first, to the formation; secondly, the concentration of these ores into economic deposits—which have been going on through these ages forming beds and veins of ore, have taken place at different periods of time, and under many varied conditions, thus yielding different results both chemically and physically.

Iron ores may be classed as follows:—

- I. Oxides
  - Anhydrous
    - Magnetite.
    - Hematite.
    - Titanite.
  - Hydrous
    - Limonite.
    - Bog Ore.
    - Turgite.
- II. Carbonates — Siderite; Ankerite; Clay Iron-Stone; Black Band.

Magnetites.

The most important deposits are found in the Triassic, Devonian, and Laurentian, of Annapolis County and Cape Breton. These deposits are now looked upon as being of sedimentary origin, and not eruptive. They may have been formed in the same manner as bog ores, the accumulation of iron sands, or the metamorphism of pre-existing ores. This latter fact is well illustrated in the manufacture of so-called metallic paint from bog ores, ochres, &c. These contain organic matter, which, in the subsequent calcination, reduces a certain portion of the ferric oxide to ferrous state, the result being a magnetic oxide of iron. The magnetites of Annapolis County are best known, being the first ores to be smelted in the Province. At Clementsport a furnace was erected in 1831 to smelt the ore occurring in the Devonian of that vicinity. Two principal beds were worked, the ore yielding from 30 to 50 per cent. of iron.

At Nictaux two varieties of magnetite are found: one fossiliferous and partly magnetic, the other a dense compact variety. From many analyses I find that these ores run

Iron	From 40·00%	to 6·500%
Silica	" 9·00%	to 15.00%
Sulphur	" 0·40%	to 0·80%
Phosphorus	" 2·00%	to 5·50%

containing also varying amounts of lime, magnesia, and alumina.

The compact variety, which is much the better of the two, has been tried here, but owing to the kilns then in use, which did not give a thorough calcination, the result was an iron rather unfit for foundry purposes, and its use was promptly abandoned. Probably if the ores were well broken up and a better selection made, with the new and improved kilns now in use they would prove valuable ores for certain classes of iron.

A deposit occurs at Digby said to be of considerable size, and comparatively free from sulphur, phosphorus, or titanium, yielding from 40 to 50 per cent. of iron.

Between Economy and Five Islands, Colchester County, at Gerrish Mountain, a quantity of ore was at one time mined for this place, and according to analyses it must have been a most valuable ore.

I have had many magnetites sent to me for analyses from almost every part of Cape Breton, but have never had reliable information as regards extent or true locality of samples. I will just state that they were generally high in iron, comparatively free from phosphorus but rather high in sulphur, and would thus necessitate roasting.

I.—Magnetites.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
FeO	23.88	21.76	70.72	.....	....
Fe_2O_3	63.79	48.34		.....	....
MnO_2	0.08	0.40	.....	.....	....
SiO_2	8.83	18.95	27.20	15.59	9.10
CaO	0.11	4.01	1.20	.....	....
Al_2O_3	trace	1.62	trace	.....	....
MgO	3.27	0.60	0.937	.....	....
S	trace	0.08	.....	0.025	0.028
P_2O_5	none	3.08	0.128	0.017	0.020
TiO_2	none	none	.....	.....	....
Iron	63.23	50.77	51.04	62.69	62.13

No. 1 from Five Islands (Smaill).
No. 2 " Nictaux "
No. 3 " Digby "
Nos. 4 and 5 from Milbury (Maynard Brown).

Hematites.

The main deposits occur in the Palæozoic, both bedded and in veins. Many varieties of ore come under this head, but the different species depending more on physical conditions than chemical composition. Hematites are generally freer from impurities than magnetites, and are much easier to reduce. They are formed by the alteration of pre-existing deposits of other ores of iron or the pseudomorphous replacement of other minerals by iron. The supply of this class of ore in Annapolis County is said to be inexhaustible. Like the magnetites of this county we find two varieties present: a highly fossiliferous hematite known as "shell ore," rich in iron but too high in phosphorus to be used for manufacture of foundry iron; 2nd, a compact variety occurring at Torbrook, discovered about two years ago, and now equipped with all the most modern appliances, &c., for the mining and handling of the ore. These mines are now turning out something over a hundred tons per day, and the ores used in connection with limonites and spathic ores in works here, yielding a very superior soft foundry iron, much prized by the foundry-man owing to the large amount of scrap it will carry in the cupola. A full description of these mines is given in the paper by Mr. R. G. E. Leckie, manager of the mines. The ore is a compact red hematite, somewhat silicious, with a perfectly tabular cleavage.

At East and West Mines of this place,

* Paper read at the September meeting of the Mining Society of Nova Scotia.

hematites occur in many varied forms. A hard compact variety of specular ore, commonly called by the miners "black ore," is found in veins of all sizes traversing the ankerite, or as micaceous ore in pockets, scattered through the soft ochrey ores; the occurence is well illustrated in the level at Cook's Brook, where the original carbonates are all decomposed into soft ochrey ores, and the specular is scattered in small stringers and pockets all through, seemingly preserving the same position as in the original ankerite. Small quantities of magnetite are also found in minute grains scattered through some parts of this deposit.

Hematites are found in many parts of Hants County, and I have had small specimens from several parts which proved very pure, although somewhat silicious, but have no certain information as regards the extent, although as usual the most positive information generally given to any question of this kind from parties sending samples is invariably, "there is any amount."

Pictou County is well supplied with specular ores and red hematite. The main deposits are at East River and Sutherland's River, where mining operations are now being carried on to supply the new blast furnace at Ferrona. Full descriptions of these deposits have been given by Messrs. Gilpin, Harrington, and others.

Among other noted localities, I may just mention St. Peters, Sydney aad Whyhogomah, C.B.; the specular ores of Roman Valley, Manchester and Melrose, Guysboro' County, at Lochaber, Antigonish County, and red hematite of Grand Lake, Halifax County. The deposits of hematite occurring in veins are generally specular and micaceous ores which are almost invariably of lesser extent than the bedded and vein deposits of red hematite, and most attention should be given to the latter.

2.—HEMATITES.

	No. 1.	No. 2.	No. 3.	No. 4.
FeO	.....	.....	8.80	.....
Fe_2O_3	79.42	77.14	66.60	99.78
Al_2O_3	5.08	7.41	8.12	.....
SiO_2	12.00	5.30	9.45	0.13
MnO_2	0.38	1.23	0.49	traces
CaO	1.90	0.49	2.50	0.02
MgO	0.35	0.57	0.49	traces
S	0.11	0.03	.....	0.11
P	0.43	0.08	.....	traces
TiO_2	traces	.....	.....	.....
BaO	traces	.....	.....	.....
Vol	.....	7.80	2.85	.....
Co_2	.....	.....	.....	.....
Iron	55.60	54.00	53.50	69.85

3.—HEMATITES (continued).

	No. 5.	No. 6.	No. 7.
FeO_2	.....	.....	.....
Fe_2O_3	75.80	75.67	92.01
Al_2O_3	4.19	0.45	0.21
SiO_2	8.26	19.43	3.68
MnO_2	0.65	0.52	2.16
CaO	6.30	1.37	0.71
MgO	.....	0.46	0.20
S	0.20	0.29	0.16
P	2.65	0.22	0.08
TiO_2	.....	traces	traces
BaO	.....	.....	.....
Vol	1.66	.....	.....
Co_2	.....	1.59	.....
Iron	53.06	54.36	64.41

No. 1 from Torbrook, N.S. Sample taken from several cars (Smaill).
No. 2, Earthy Red Hematite (Turgite) West Mines (Smaill).
No. 3, Earthy Red Hematite (Turgite) Old Mountian (Smaill).
No. 4, Micaceous Ore, East Mines (Smaill).
No. 5, Fossiliferous Red Hematite (Shell Ore) from Nictaux (Smaill).
No. 6, East River Red Hematite (MacAdam).
No. 7, East River Specular "

Limonites.

Limonite proper occurs in true veins, and is the result of decomposition of pre-existing ores in situ. The deposits of most economic value discovered so far are those of Colchester and Pictou Counties. At Londonderry extensive mining operations have been carried on since 1849. The belt of ore has been traced from east of the East mines running west a distance of over twenty-five miles, varying from half to two miles in width. Ore occurs in rocks of the Middle or Upper Silurian. The veins are very irregular both as regards size and contents. As regards the origin and formation of these deposits, Sir William Dawson gives the following solution.—

1. Formation of fissure;
2. Igneous formation of a deposit of iron, lime and magnesia carbonates;
3. Breaking up these by faults and cross fractures;
4. Partial roasting of contents;
5. Action of heated waters;
6. Action of the air and atmosphere.

The original deposits being altered under different conditions as regards time and agencies, the result being that we find almost all varieties of carbonates, hydrous and anhydrous oxides of iron present. Also the original vein stone in all stages of metamorphism. In the mining of these ores boulders of ankerite are met with, which almost invariably will be covered at sides and back with quantities of specular ore or limonite. The limonite often occurs in large hollow masses of irregular shape, which, when broken, contain water, and the inside surface presenting mammalated, stalactitic or botryoidal structures. Sometimes brecciated masses of the country rock are found in the interior cemented together by the ore. Large concretionary balls of ore are also found which when broken in half show white ore in the interior and different zones of oxidation and even dehydration. In these lumps, just outside the ankerite, will be noticed a small quantity of ochre, then a thin ridge of compact limonite, or perhaps a whole series of concretionary bands of limonite surrounding one another, and between each layer small quantities of soft ochre, in some cases the whole mass covered with a layer of hard black ore. Large quantities of an ochre to a compact red hematite are mined which are newer than the limonites, being formed from a more recent decomposition of the ankerite. This mineral is really turgite, being a red hematite and invariably containing combined water. It is one of the most easily reduced ores and generally very pure, running as high as 58% metallic iron, any foreign matter generally being in the shape of lime or magnesia, which of course are not deleterous elements. Some 15 years ago, when experiments were being carried on at the Newton works of the Steel Company of Scotland with the Danks rotary furnace, the lump ore used in the experiments was brought to Scotland from these mines. New levels have been opened lately; the ore mined and indications are very favourable indeed for future workings.

The limonites of Pictou County have been treated in full by several writers, much more competent to talk about them than myself. The ores of what is known as the East River district, are now being mined in large quantities for the coke furnace at Ferrona and charcoal furnace at Bridgeville. The principal deposits occur along the contact of Silurian and Carboniferous rocks. Ore is generally associated with calcite and small crystals of baryte. Some of the deposits contain notable quantities of maganese. Lumps have been received here at different times to be used as fettling in the mill. The iron contents averaged 50 to 55 per cent of iron.

Large quantities are also found near Brookfield resembling West Mines ore very much, some of which has been used here at mill and furnace working very satisfactorily. The average of 15 cars was 45.15% metallic iron. A variety of a dark brown calcareous limonite occurs at Pugwash, some having been mined and tried here, but owing to the high manganese contents it is found to produce too hard an iron for foundry use.

I have had samples sent me lately from near Grand Lake, Halifax County, which the owner of the mine claims is a true vein deposit of limonite, but appearance, &c., of the ore incline me very strongly to think it simply a dip of bog ore.

Limonite occurs in many other localities of the Province, but only those of Colchester and Pictou Counties have received anything like the degree of attention they deserve.

Bog Ores.

These ores are of modern age, found in many places in Nova Scotia, and elsewhere, on the sites of old swamps at or near the surface, and generally in sandy regions.

They have been formed in many ways thus: Waters containing carbonic oxide permeating the older rocks containing ferriuginous matter would dissolve some of the iron, find their way to low swampy regions where the water charged with organic matter and organic acids would combine with the iron. In course of time the water would become impregnated with these salts of iron, which would become oxidised at the surface of the water, forming a thin film, which gradually thickening as the process of oxidation went on until it sank, when another film would start forming, &c.; this process continuing would eventually result in a bed of ore, consisting chiefly of peroxide of iron, in combination with water and organic matter; or, again, rain water falling upon decayed leaves or vegetable matter, would take up the organic acid formed, and running down the sides of hills, &c., passing over any strata containing iron would dissolve some of the iron, and, finding its way to low regions, there becoming concentrated, as before mentioned, beds would be formed in the same manner. These classes of ores are among the principal ores used in Sweden and Norway, also at the St. Maurice forges in Province of Quebec.

Manganese is almost always present, from mere traces up to 20%.

Sulphur generally in only very minute quantities. Phosphorus from traces to 2 or 3 per cent. Combined water and organic matter from 15 to 35 per cent. It is this class of ores which generally form magnetite. They are found scattered all over the Province, in Annapolis, Halifax, Kings, Hants, Colchester, Pictou, and Antigonish Counties, also in Cape Breton.

Ochres.

These are formed in the same way as bog ores, or are the result of decomposition of other ores of iron. Large quantities of these are not admissible in the blast furnace owing to the tendency to choke the furnace. They are found in almost every part of the Province, in greater or less extent. Generally called paint by miners. They are of all shades of colour from light yellowish to reddish brown and brownish black. Sometimes they are greyish when containing a large amount of ferrous oxide. When formed from the decomposition of ankerite, they generally contain micaceous specular ore, which often occurs in original ankerite. The light yellow variety is almost invariably the richer in iron, the darker variety seemingly containing more manganese.

Light Yellow.		*Dark Brown.*	
Iron,.....	62.64%	Iron,.....	36. %
Ins.....	traces.	Ins.....	8.90%
Volatile,.....	10.60%	Volatile,.....	8.00%
		Manganese,...	14.42%

These two specimens were from the same pit.

Carbonates.

Siderite and Ankerite.

Main deposits are at West and East Mines, Colchester County, and Sutherland's River, Pictou County. They are of igneous origin. Two main exposures are worked at East Mines to supply the furnace here; they are known as Slack's field and Totten Hill. Both are open quarries about half a mile apart, each being about a hundred feet long, fifty wide and eighty deep. Totten Hill contains more specular ore running through the mass than Slack's field, and is thus slightly higher in iron. These ores before being used in the blast furnace are calcined by new and improved kilns, which increases the value of the ore as regards the percentage of iron &c., 30 to 40 per cent. The value of this class of ore consists not so much in amount of iron it contains but in the valuable fluxing properties it possesses; 120 lbs. of calcined ore being equal to about 100 lbs. of limestone; cost of calcining is only about 10 cents per ton. The deposits at Sutherland's River, Pictou County, are of the same class, but have not been worked to any great extent as yet.

Clay Ironstone.

This is found in different parts of the carboniferous areas of the Province. The ore is a compact, argillaceous carbonate of iron, greyish to black in colour. It is said to occur more frequently in Cape Breton. This class of ore is most largely used in England and Scotland in the manufacture of their pig iron, but has not yet been found in any large quantities in Nova Scotia. The iron contents vary from 15 to 35 per cent.

Black Band.

This is found in all the coal measures in Nova Scotia. It is really a clay iron stone containing a large amount of organic matter. Both of these last varieties have been experimented with here, from Pictou County, but the parties sending did not seem to use enough discretion in sorting the clay and slate from the ore, which generally carried something over 2 per cent. of sulphur in the mixture.

It seems strange that Cape Breton, containing some of the most valuable coking coals in the Province, and reported to contain so much iron ore, should be so long in having any real information concerning extent and character of its deposits.

In conclusion the writer presents this paper to the Society, and the accompanying specimens, simply as a probable means of provoking discussion as to the general character and extent of the ores of the Province.

Analyses.

4.—Brown Ores.

	No. 1.	No. 2.	No. 3.	No. 4.
Fe_2O_3	67.14	84.67	51.449	68.01
MnO_2	1.67	0.17	0.871	5.67
SiO_2	15.60	2.37	16.755	5.40
CaO	0.87	0.22	0.180	2.50
Al_2O_3	4.11	0.21	6.70	.....
MgO	0.12	0.13	0.125	.....
S	0.03	0.001	0.123	.....
P_2O_5	0.13	0.077	0.460	.....
Vol	10.37	11.54	10.11	16.30
H_2O	23.00	0.45	25.00	.....
Iron	47.00	59.17	36.014	47.61

No. 1, Average sample West Mines Ore. (Smaill).
No. 2, Fibrous Limonite, West Mines. "
No. 3, Paint from Old Mountain under turf. "
No. 4, Pugwash, Calcareous Limonite. "

5.—Brown Ores (continued).

	No. 5.	No. 6.	No. 7.	No. 8.
FeO	60.62	40.41	66.21	71.421
MnO	6.51	8.46	traces	2.87
SiO	17.10	4.30	17.0	11.50
CaO	.....	14.78	0.21	0.75
AlO	.....	.....	4.21	1.08
MgO	.....	.....	0.25	1.064
S	.....	.....	1.36	0.102
PO	.....	.....	0.32	0.140
Vol	15.70	26.00	10.30	11.0
HO	.....	.....	.....	25.0
Iron	42.43	46.35	46.35	49 955

No. 5, Pugwash, Calcareous Limonite. (Smaill).
No. 6, do do "
No. 7, Brown Ore. near Truro, containing iron pyrites (Smaill).
No. 8, Average of Paint, from Old Mountain (Smaill)

6.—White Ores and Ankerite.

	No. 1.	No. 2.	No. 3.	No. 4.
FeCO	68.35	66.28	15.30	88.59
MnCO	1.90	2.75	2.57	2.85
SiO	0.53	0.35	0.33	2.70
CaCo	2.66	9.0	69.71	1.53
MgCO	25.46	21.54	11.97	3.48
S	.....	.....	.....	.....
PO	.....	0.02	.....	.....
AlO	.....	.....	.....	.....
Iron	32.85	32.0	7.37	42.76

No. 1, Dark Pearl Grey, ftom East Mines; almost a true Mesitite (Smaill).
No. 2, White Ore, Cream-colored, West Mines (Smaill).
No. 3, Starry Ankerite, East Mines (Smaill).
No. 4, Spathic Ore, Sutherland's River (Thorpe).

Analysis No. 7.

	No. 1.	No. 2.	No. 3.
FeO	.....	.....	43.75
MnO	.....	1.51	1.812 1.47
SiO	....,	2.10	3 0 3.36
CaO	.....	16.10	22.90 21.97
AlO	.....	6.0	3.77 8.37
Vol	.....	38.50	36.87 5.89
MgO	.....	8.28	2.88 15.0
S	.....	.....	..... 0.023
PO	.....	0.075	traces. 0.019
Iron	.....	25.25	26.45 30.625

No. 1, Average White Ore, Ankerite, &c., Slack's field (Smaill).
No. 2, Average White Ore, Ankerite, &c-, Totten Hill (Smaill)
No. 3, Sample of Calcined Ore from kilns (Smaill).

CORRESPONDENCE.

The Sydney and Louisburg Coal and Railway Co.

Sir,—It would be interesting and instructive to learn the true why and wherefore of the very poor financial shewing made last year by the Sydney and Louisburg Coal and Railway Co. So far as we residing in Cape Breton could judge, the company did a rushing business. Prices were better than they had been for many years and this company for the first time in its history, and with a mining of 170,000 tons, surpassed all the other Cape Breton mines in output. No accidents or strikes occurred and the despatch given to their time-chartered steamer carrying coal to St. Lawrence ports, was so satisfactory, that the net return for this, the greater part of their output, must have been considerably higher than that of most of their competitors, and yet we find that under these most favorable circumstances, their net profit was the paltry sum of £1,120!

Can you, Mr. Editor, throw any light upon this matter? I think it is one in which Canada generally, and Cape Breton in particular, are interested, inasmuch as disappointed shareholders are wont to blame the country, its people and its resources for the failure of an enterprise such as this and it would be grossly unfair that they should do so in this case.

It would not have occurred to me to apply for a notice of this subject in your columns, had I not recently read in a London financial paper a report of the last annual meeting of the company and noticed with astonishment that the chairman explained to the shareholders the expenditure of a large amount (over £1,300) by the statement that damage necessitating such an outlay had been done to the Sydney pier in April, 1891, by a "heavy impact with running ice." Now, Sir, no reputable resident in Cape Breton will say that any such impact ever occurred or that repairs of such cost were made.

When one sees large amounts explained away in this manner, and when, moreover, it is a matter of public notoriety that a syndicate composed of three of the company's prominent servants, have recently sold for a large sum to the company, coal areas which only cost them the amount payable for fees to the Mines Department, it is natural that suspicions shouid arise of a "nigger on the fence" somewhere, and that protest should be made against blaming upon Cape Breton and its natural resources the failure of this company to make a satisfactory return to its shareholders until it is proved that such blame does not rest elsewhere.

Yours, etc.,
Verbum Sap.

Sydney, C.B., 25th Oct., 1892.

Another Quack Skips Out.

Sir,—The notorious Robert H. Ahn has left here for parts unknown, and in the interests of mining it is to be hoped that he will never come back. He has done more harm to the mining interests of this district than any other man who has ever been here.

(1.) He persuaded a lot of tenderfeet (all respectable men) in Toronto, to go into a scheme for building reduction works at Nickel City, two years ago, and thereby hangs a tale. He knew nothing about building any more than about mining, and the works he put up are the laughing stock of the range. They are more like a habitant's barn than anything else. His object was to test a wonderful separator he had invented (patent applied for). But it would not work of course. The result was that the company lost some $13,000 through him. All they realized was $1,000 received for the machinery. The workmen had to take 75c. on the $1 for wages, after four months' waiting, and legal expenses, etc.

(2.) Last spring he took a contract to open up a nickel claim in Denison and get out ore, as explained in the enclosed letter (from Sudbury *Journal* of this week), but did not pay the men, and he tried to throw the blame on the Emmen's Metal Co. The poor men may whistle for their wages now, to the tune of $400.

He left Sudbury the other day—without paying his office rent. There are numbers of judgments against him here and in Toronto. He said he was going to Montreal—to others that he was going to Boston—and coming back next spring to boom the range! But no one expecrs to see him back again.

Now it would be a good act for you to "head him off," as you did with Dobson, as he is a bad egg, and will doubtless turn up in some other mining region at his old tricks. I thought it my duty to let you know these facts, and you can make any use you wish of them.

Yours faithfully,
A. M.

Sudbury, Oct. 25, 1892.

Dobson in New Brunswick.

Sir,—I read the remarks in your issue for August, also in your previous issues, with regard to Charles Miles DeTracey Dobson and the *Critic*, and the conclusion I draw is that you are quite correct in your proof that the *Critic* was deceived by this man as well as yourself, but I do not think it is quite in order to suppose the *Critic* is the greater fool—for the gentleman must have gained considerable experience in the art of deception between times. So much for that.

The issue of your paper of August quotes from the *Critic* that part of the gentleman's letter in which he re-

fers to his *experience* in mining, among others "New Brunswick, 1892." Now I know something about this experience, as I was present at his very arduous and extended scientific researches on that occasion. He expended exactly 40 minutes in actual work of examination of formation and extent of ore in sight in that year, and that was upon my property on Jordan Mountain near Sussex. In the same proportion his 15 other experiences would amount to 600 minutes more—in all quite an extended experience.

He, after his forty minutes' experience upon my property, as I understood, reported the property not worth more than $15,000 in any event, but it was not developed as yet, and of course it was not worth anything, and this in the teeth of the fact that he would not undertake to say there was not actually 1,000 tons of ore in sight.

On this occasion I lent Mr. Dobson a printed pamphlet connected with the title to the property, which he was to return to me without fail. I have written to him to return it, but can get no answer. I sent a friend of mine to call on him at his office, and he informed me "there was a notice on the door that he was *absent* examining some mining property," and afterwards that as a matter of fact he had not been out of town at all. I have not yet had the pamphlet returned and am now inclined to think a great deal of what you say of him is true.

Yours, etc.,
F. W. STOCKTON.

SUSSEX, N.B., 26th Oct., 1892.

Reflections after a Trip to Kootenay.

SIR,—In response to your request to give you a few remarks upon our late visit to the mining camps in East and West Kootenay, B.C., we now jot down some of our impressions of that locality which is engaging so much public enquiry and attention.

Former discoveries at Illicillewaet, Ainsworth, and elsewhere, have been eclipsed by the later and richer exposures of argentiferous lead ores in the Slocan district of West Kootenay. This region is now the ruling centre of attraction, and promises to become a veritable New Denver, as the town site near the Slocan lake is appropriately named. Even the Toad Mountain excitement is quieting down by the hope deferred of seeing the sale of the "Silver King" property realized, and while Nelson is suffering from this delay and disappointment, her rival, Kaslo city, steals a long march ahead.

I will not dwell upon the description of localities or geological phenomena, which have been well hackneyed of late, but confine my observations to a few generalizations equally important as factors in the future development of all mineral regions.

At the risk of being considered by some a somewhat unjustified pessimist, we must confess that the immediate future of the silver-lead mining industry in the West Kootenay, or even the Slocan, does not offer to us any covetous excitement, and we have not hesitated to advise our friends accordingly. The complex character of these lead ores have not received the careful investigation and recognition of practical metallurgists. The average prospector who creates a local and evanescent boom by his latest assayer's certificate of a "specimen" returning the silver away up in the hundred of ounces to the ton, much less thinks it necessary to obtain a reliable opinion upon the real market value of his find with due regard to presence of deleterious constituents.

The smelting properties of such ores and their adaptation to fluxes, and other complemental minerals easily procured in the locality, form a factor in the question of successful utilization of the minerals equally important with the conditions of fuel and transportation, but such matters do not disturb the fools' paradise of infatuated investors.

No doubt there are some properties in this remarkable region which will yield wealth to their owners in face of all handicaps by virtue of their high tenor in silver, and as a fact such ore is being sold to American smelters, and yield a good profit under the very heavy cost of present means of transportation, and a custom duty of over twenty dollars a ton; but these are the lucky numbers, or the plums of expert selection, and form an offset to the less fortunate enterprises.

Another just cause of present anxieties is to know the ultimate route of the "projected" railways; the powerful restrictions and influences of invested interests and existing charters are not likely to militate for the good of the many.

Existing circumstances indicate that, in spite of the McKinley tariff, the first phase of this new lead producing field will evidently follow the precedent of others in their first period of development, namely, to furnish its products as raw material for existing silver smelting centres, for our American neighbours with their experience in smelting problems are alive to the importance of securing a supply of such of our "wet" ores as may suit their demands; we shall thus be exhausting our mineral resources at a minimum of profit to ourselves, and see the more remunerative operations of metallurgy and manufacture effected on other territory by American labor, while the roads of transportation will to a large extent be constructed also by American capital. "None but the brave deserve the fair," and if British and Canadian capitalists are phlegmatic and slow in the race they cannot expect the prize.

The question of the disposal of lead in our own country is not to our mind so serious a one as at first sight. Cheap lead, as is the case with any other staple commodity, means a larger consumption of lead, but more than this, it would appear that a silver-lead ore which can withstand the heavy charges of transport to the American smelters, and pay a duty of one and a half cents per pound of lead, has a very large margin to encourage its treatment on our own territory, if only for the silver contained, and disregarding the lead altogether, unless the value of silver continues to depreciate.

While the silver-lead mining industry of the Kootenay thus offers unsolved problems and many risks, except to the favoured few, and the copper ore deposits equally demand the highest order of expert knowledge for their utilization, the simpler subject of "gold mining," which has hitherto been too much neglected in Canada, and especially in British Columbia, cannot fail to force itself upon the consideration of any observant traveller in that Province.

The history of all important gold producing countries commences with the gold "digger," or more properly, gold "washer," of the placers or river gravels, followed by the more steady quartz mining upon the subsequent discovery of the mother ledges or reefs. British Columbia has had its gold fevers thirty years back, and perhaps no country offers more extent of already known auriferous territory, and yet it does not so far possess a single working gold mine of any development, and this is the more extraordinary, as the difficulties of transportation and communication necessarily existing in a newly explored country do not exclude the feasibility of gold working to the same extent as they do the exploitation of other mineral wealth in the form of the baser metals. In the case of gold mining, our only care would be to carry in machinery and supplies to the location; the question of the transportation of hundreds of tons to market does not present itself as with the ores of the base metals, and the monthly product of a very large concern may be, in fact, contained within so small a compass and weight as to be portable by a single person, and consigned to the bank, where, after a few hours, required for the verification of the assay or "standard" of the bar, its equivalent in legal tender may be withdrawn, wherewith to pay current cost, and this without the disappointing fluctuations inherent to every other product.

Our short tour through only portions of East and West Kootenay, has been sufficient to impress us with the neglected gold deposits offering rich returns for the working, and leaving aside the hydraulic claims which usually present serious engineering difficulties, we are of opinion that no better opportunities for immediate legitimate investment in the Kootenays can be found than those offered by certain localities of the Selkirks in that region. The modern improvements in gold milling and reduction have rendered it possible to economically secure, say from 85 to 95 per cent. of the contained value, even from the formerly so-called "rebellious" or "refractory" ores; and *apropos* of this, while the Cassell or McArthur-Forrest Cyanide process is being extensively advertised in the West, let all persons who would think of adopting that process or plant avoid unnecessary expense by duly investigating the alleged validity of the patent rights claimed by the speculating syndicate formed for the purpose of monopolising, if possible, our Dominion, before they voluntarily manacle themselves by a binding contract; there is certainly no secret or diffculty in the process warranting the necessity of any assistance from this syndicate and the plant is only that of any other ordinary leaching or lixiviation process, but of this more anon.

To resume, Mr. Editor, after generalising our observations and notes from the very pleasant two months spent in East and West Kootenay we are inclined to think that profitable developments of the immense mineral wealth already exposed there, so far as silver lead ores and copper ores are concerned, will be slow to be realized, save for a few deposits exceptionally rich in silver, and many disappointments must follow the present inflated excitement, and much capital locked up for an uncertain period, and we would draw attention to the more readily realisable benefits to be secured by the investment of capital in the neglected gold resources of this and other districts in British Columbia.

J. LAINSON WILLS.

OTTAWA, Oct. 23, 1892.

Endless Rope Haulage.—The endless rope system of haulage, which has displaced the single rope system at the Mitchell Main Colliery, is described by Mr. T. W. H. Mitchell, At this colliery the Barnsley bed is worked on the long-wall system, at a depth of 307 yards. The engine is placed on the surface and runs at nineteen to twenty revolutions per minute, and drives the rope at about fifty yards per minute. The rope is 1¼ inch in diameter, and is wrapped three and a half times around a taper drum 9½ feet in diameter. Trucks are attached to the rope by chains 12 feet long, one end being hooked to the draw-bar and the other end wrapped twice round the rope, and the hook brought across the chain when extended. Catches and means for returning the vehicles to the rails are fixed every few yards. and a guide rail is fixed between the two tracks to prevent the full trucks from fouling the empties. Illustrations are given of the general arrangement of the plant and of the forms of the pulleys and other details employed. An endless rope haulage plant has been laid down at the Kramstamine, near Konnadsthal, in Lower Silesia. It has a total length of 1.7 miles, more than half of which is above ground. The wire rope used passes through forked prongs, one on either end of the waggon being hauled. —(Transactions of the Federated Institution of Mining Engineers, vol. 3, pp. 147-156.)

LEGAL.

WILLS vs. STEWART.

More Side-Lights on the General Phosphate Corporation—Sando tells how the Company Originated, and owns up to Fat Commissions—A Hundred per cent. not unusual in London.

The adjourned hearing of this suit was taken up by the Hon. Justice Malhiot at Aylmer on 3rd instant.

Managing Director Sando, Mr. J. Keith Reid, late one of the Corporation's mine superintendents, and others, gave evidence.

Mr. Brooke, in opening the case for the plaintiff, said it was not one which presented any very involved issues, either of law or of fact. The plaintiff sued for a commission on the sale of mining lands, and the main question to decide was upon what amount that commission had to be calculated. The action is based upon a letter written by the defendant, and handed to the plaintiff, couched in the following terms:

LONDON, Feb. 20th, 1890.

DEAR SIR:

In consideration of your professional services rendered, and now rendering, in connection with the sale of the following phosphate lands in which I am interested, that is to say: (a list of lands being here given) on a sale being effected of a part or whole of the foregoing properties, through the aid of your aforesaid professional services, I agree to pay 2½% of the cash sale obtained.

GEORGE STEWART.

The defendant's pleadings seek to cloud the contestation by various pretensions, of which the court was not, he thought, likely to take much notice. For instance, it is denied that the sale was effected through aid of the plaintiff's professional services. In reply, he would say the evidence showed unmistakably plaintiff's part in bringing about the sale, and Mr. Stewart himself, when examined under oath, frankly acknowledged that he had paid to the plaintiff the sum of $2,141 or thereabouts on account of this commission. It is not to be supposed that he would have paid this sum had not a commission been due. Another ground of defence is equally frivolous. It is, that after receiving the letter referred to, the plaintiff became the employee of the General Phosphate Corporation, and that the services in question were rendered by Mr. Wills, not in virtue of this letter, but as agent of the corporation. The first words of the letter show the hollowness of this pretension. They are: "in consideration of your professional services *rendered and now rendering*," and the Corporation was not formed until long after that time.

On the main question, upon what sum the commission should be given, the plaintiff had filed a deed of sale from the defendant to the General Phosphate Corporation. The price mentioned was £40,000, of which £10,000 was paid in cash, £20,000 in mortgage, which had been received and accepted by the defendant as the equivalent of cash, and £10,000 had remained in the hands of the Corporation as security for an outside liability contracted by defendant, i.e., he was to manage the mines for the Corporation, and he agreed to take out 10,000 tons of phosphate on or before a certain date. Defendant pretended that, not having fulfilled this obligation to the corporation he was not liable for a commission, but the plaintiff's counsel submitted that it was in evidence that he had another consideration for making this agreement, viz., his appointment as manager for the Corporation, and that, moreover, it was shown that he had compromised for this £10,000 by receiving £1,000 in cash and £5,000 in shares of the corporation, on which he should in any event pay commission at their par value. Plaintiff also urged his right to commission on this £20,000 received by defendant in securities. It was not contended by the latter that these securities were not worth that amount; but he claims to have paid commissions and other sums to the extent of over £14,000, and wished to exempt this from the plaintiff's claim. Mr. Brooke argued that although it appeared by the evidence that the defendant had actually paid £11,000 of this amount to one Knud Sando in return for his services in negotiating the sale, that the plaintiff was in no way party to the transaction, and not even aware of it; that the sum paid Sando was exorbitant and ridiculous; that Mr. Stewart had a right to pay him whatever sum he chose, but he should not expect to make the plaintiff contribute. The transaction between Stewart and Sando was in reality a fraud upon the General Phosphate Corporation, because the evidence showed that that Corporation was ignorant of the fact that it was paying £40,000 for property which its agent was purchasing for it for £29,000, and that the sale was made directly from Stewart to Sando in order to effect this fraud.

Mr. Aylen, in his reply, said that there was not one particle of evidence in the record to connect the plaintiff, in any way whatever, with the sale. The witness Sando had sworn that he. himself, had gotten up the General Phosphate Corporation without any assistance whatever from the plaintiff, and that corporation had been formed for the purpose of making the purchase referred to by the letter on which the plaintiff relied. Defendant had only undertaken to pay the commission if the sale should be effected by the aid of plaintiff's professional services, and it was incumbent on him to show that these services had contributed to bring about the sale. On the contrary, the evidence went to show just the reverse. Immediately after receiving this letter the plaintiff appears to have

occupied himself no more in the matter, but started off at once for South America, where he remained away almost all of the time which intervened between the letter and the signing of the agreement of sale from Stewart to the General Phosphate Corporation. There was no proof even in what plaintiff's services consisted. It was shown that he had made some reports upon the property in question, but these reports had been paid for by the defendant some months before the giving of the letter in question. Mr. Wills had been examined himself and could not say what he had done except that he claims to have seen a few people and talked phosphates to them. Under the circumstances the plaintiff had received far more than he had any right to claim. Mr. Stewart had acted generously in the matter; he might have said to Wills, you did not really help to bring about this sale, and refused to pay him anything; but he did not do this. He said, we will not discuss that question; I will pay you a commission on the amount which I have actually benefited by the transaction. It was true that Sando had received an enormous commission, an exaggerated commission, it might be an exorbitant commission; but the defendant had paid it, and paid it willingly, because he was getting, even with the deduction of this commission and the further sum of £10,000 to be left on deposit, a very high price for his property. Under the circumstances a commission on the price realized is all that the plaintiff is entitled to.

Mr. Brooke made a brief reply, and the case was taken under advisement.

Mr. Sando's evidence is so interesting that we give it in full:

THE EARLY HISTORY OF THE CORPORATION.

Knud Sando, of London, England, aged 46, merchant and manufacturer, examined by Mr. H. Aylen, counsel for defendant:

I am neither related, allied or akin to, or in the service or employ of any of the parties in this cause. I am not interested in the event of this suit.

Q. Are you in the employ, or have you ever been engaged by the General Phosphate Corporation? A. I am their managing director.

Q. Do you know the properties sold to this Corporation by the defendant? A. Yes.

Q. Who organized and formed the General Phosphate Corporation? A. Myself.

Q. Did the plaintiff give you any assistance in doing so? A. No.

Q. Under what conditions, and for what considerations were the properties above referred to sold to the General Phosphate Corporation by the defendant in this cause, and who negotiated and brought about the sale thereof?

Objected to the first part of this question as illegal. Objection reserved by consent of parties.

A. The properties were first offered to me by Mr. Butler and Mr. Gascoigne, brokers, of London, about the month of May or June, 1889; in October following, I believe, the defendant was introduced to me by those persons, and my subsequent negotiations for the purchase of the property took place with the defendant. After the General Phosphate Corporation was properly organized in the month of July, 1890, the property was offered amongst others by me to the General Phosphate Corporation, to the directors of the Corporation, and in September, 1890, the corporation agreed to purchase them, and to enter into a contract or a preliminary contract with the defendant to purchase those properties with others; the said contract specifying that the defendant was to work all the properties of the corporation, and was to produce from them 10,000 tons of phosphate inside of 12 months from the date of the fixing of the machinery on the property; the price agreed upon to be paid was £40,000 total, on which the defendant was to receive £29,000. In payment of the purchase price he received £10,000 cash and a mortgage for £30,000. There was also a condition in his contract for the performance of his undertaking, that he was to forfeit £10,000 to the Corporation if he failed to produce that quantity of phosphate.

Q. Do you know whether 10,000 tons of phosphate were delivered? A. No; they were not.

Q. Please take communication of the document now produced, and marked Exhibit K1 (Stewart's commission note to Sando) at Enquete, and state whether it is a copy of the letter written by the defendant to you?

Objected to this question as illegal inasmuch as the defendant cannot avail himself in this cause of an agreement of the nature sought to be proved. Objection over-ruled

A. Yes; it is a correct copy of the letter which the defendant gave me.

Q. Had this letter any influence to induce you to take up the sale of these properties? A. No; it had no direct influence.

Q. Would you have gone and made the sale without that? A. No; certainly.

Q. Did it form the basis of your dealings with the defendant in future dealings? A. Yes.

Q. Please take communication of Exhibit K 2 at Enquete, and state whether it refers to the same properties which are referred to in Exhibit K 1?

Objection to this question as illegal inasmuch as the defendant cannot avail himself in this cause of an agreement of the nature of the one sought to be proved. Objection over-ruled.

A. Yes; it is a copy.

Q. Does it refer to the same properties which are referred to in the other letter? A. Yes.

Q. Was it after the writing of Exhibit K 1 that you took up the organization of the General Phosphate Corporation and the sale of these properties? A. No; I took up the organization of the General Phosphate Corporation 12 months before that.

Q. Was it after you had communicated with Mr. Stewart that you began to organize the General Phosphate Corporation? A. No; I only knew Mr. Stewart some months after I began to organize the Phosphate Corporation. The property was first offered to me, and I had hundreds from which to choose.

Q. Was it before or after you began to organize the General Phosphate Corporation? A. It was after I had begun.

Q. When was the organization of this company completed? A. In the month of July the company was organized; in the month of July, 1890. The preliminary contract for the purchase of the property took place in the month of September, and the complete purchase took place in the month of October or November; the deeds will show it; I had nothing to do with the completion of the purchase.

Q. Did the defendant agree to forfeit ten thousand pounds out of the twenty-nine thousand pounds referred to in Exhibit K1 on his failure to deliver ten thousand tons within one year.

Objection to this question as being illegal and as not being susceptible of being proven by oral evidence. Objection reserved by consent of parties.

A. Yes; it is included in the contracts.

Q. Please take communication of the document produced as Exhibit L in this cause, with the deposition of Mr. Benson, and state whether you are the Mr. Sando therein mentioned, and for what consideration the transfer mentioned in the certificate was made?

Objection to this question as illegal and irrelevant. Objection reserved by consent of parties.

A. That is a copy.

Q. You are the Mr. Sando that is mentioned there? A. Yes.

SANDO'S BOODLE.

Q. I see that it is mentioned in this document that on the twenty-nine thousand pounds to be received by Mr. Stewart from the General Phosphate Corporation and which was secured by a mortgage, that you were proprietor of £11,000? A. Yes.

Q. What service did you render the defendant for that? A. First, for the sale of this property, and afterwards for negotiating the sale of his mortgage; and as acting for Mr. Stewart, particularly as his agent for the sale of the property, and the mortgage after that.

Q. Did all these services for which these £11,000 were given, have reference to the phosphate properties sold by the defendant to the General Phosphate Corporation? A. Part of them, but not all; it arose out of that. They are the services which I rendered on the first sale of the property to the General Phosphate Corporation, and afterwards on the selling of the mortgage given in payment to Mr. Stewart.

Q. The mortgage referred to the property sold? A. Yes.

Q. And was for £30,000? A. Yes.

Q. I suppose that the execution of this Exhibit L was the following out by the defendant of the terms contained in Exhibit K1? A. Yes.

Q. Giving you £11,000? A. Yes.

Q. That would leave from the original price of the sale to the General Phosphate Corporation a balance of £29,000? A. Yes.

Q. On these £29,000 I understand that £10,000 were retained? A. Yes.

Q. By the Corporation? A. Yes.

Q. And were forfeited by the defendant for non-delivery af the phosphate? A. Yes.

Q. According to the contracts? A. Yes.

Q. What was realized by the sale of this mortgage after payment of the commission? A. I would have to speak from memory; but we were obliged to pay the discount and the assurance; to the best of my recollection it realized about sixteen thousand pounds net, after we had paid all the charges.

Q. And on the £16,000 how much did you retain in virtue of Exhibit L?

NETTED £9,000 STG. BY SALE OF STEWART'S SECURITIES.

A. I netted a little over £9,000, because I paid all the expenses; the defendant realized between £5,000 and £6,000 in all, after having paid all the expenses and the expenses contributary to the sale.

Q. Are yon aware whether the defendant in connection with the sale of this property was obliged to pay a commission to Kimberly & Co.? A. Yes; I know that judgment was rendered in that cause.

Objection to this question as illegal and irrelevant. Objection reserved by consent of parties.

Judgment was given in a case for £500 and the costs; in the other one I do not remember for how much judgment was given.

Q. Was it for a considerable amount? A. It was for at least £500 if not for more.

Q. Did all these commissions arise out of commissions on the sale of this property? A. Yes.

Q. When did you first see the defendant? A. I believe that it was in the month of October, 1889; it may have been September, but I believe that it was in the month of October, 1889, that he was first introduced to me.

Q. Did the plaintiff in this case render any services for the defendant subsequent to the month of October, 1889, which contributed to the sale of these properties to the General Phosphate Corporation? A. No; not that I am aware of.

Q. In organizing the General Phosphate Corporation did the plaintiff assist you in any way? A. Not as far as organizing the company goes.

Q. Did the defendant in submitting the said property for sale furnish any reports from the plaintiff for a portion of it? A. Yes.

Q. What were the dates of those reports? A. I don't remember.

Q. Were they all dated before the interview which you had with the defendant? A. Yes.

Q. All dated before the month of October, 1889? A. Yes.

Q. Therefore, what was then the cash value of the sale of the properties sold by the defendant to the General Phosphate Corporation after deduction of all commissions? A. About £16,000; speaking from memory.

Q. Would that be after having deducted the commission of Kimberly & Co.? A. No; it had nothing to do with that.

Q. That would have to be deducted also? A. Yes.

Q. How long were you in effecting the sale to the General Phosphate Corporation, and how long afterwards were you in effecting the sale of the mortgage? A. After the organization of the Corporation, about the fifteenth of August, 1890, I submitted a memorandum showing all the properties offered the Corporation, and I recommended certain properties to be bought, including those of the defendant. The signature on the preliminary contract referring to the purchase was annexed about the 12th of September to the best of my recollection; but I had the properties under my consideration for about 12 months previous. The sale of the mortgage took quite a while—several months; it was only effected in the end of the winter 1891.

Q. How many tons of phosphate did the General Phosphate Corporation receive from those properties up to the present time? A. About 3,000 tons.

Q. And for how many years have they been worked? A. From actual work it is 18 months since the machinery was fixed up on the property.

Q. Are you speaking particularly of those properties? A. No.

Q. But I am speaking of those properties sold by Mr. Stewart; can you give us an idea? A. No; I could not; perhaps about 1500 or 1600 tons which we received from those lots.

Q. And according to the contract the defendant was obliged to deliver 10,000 tons during the first year? A. Not on his property; on all the property of the General Phosphate Corporation.

Q. Did you organize the General Phosphate Corporation with the object of establishing phosphate industry in Canada? A. Yes; in Canada and elsewhere.

Q. And you wanted to recoup yourself of your expenses by organizing, and for the organization of this company by taking a commission on the sale of these properties, I suppose? A. Yes.

Q. Did the defendant have a complete title to all the properties referred to in these Exhibits, K 1 and K 2, when he was in London? A. No.

Q. Was he obliged afterwards to acquire a title to those lots? A. I believe that he was desirous to acquire a title according to the contract: I believe that he completed the title sometime afterwards.

Q. That was one of the conditions with the General Phosphate Corporation? A. Yes.

Q. Did the plaintiff take part in the drafting of this deed from the defendant to the General Phosphate Corporation? A. Not that I know of.

Q. Would you know it if he had? A. I believe so; I was present with the lawyers when they drew up a deed, and the deed was discussed; that is to say the preliminary contract. As to the other contract, I do not know anything about it. It was only a confirmation of the preliminary contract.

Q. Was the plaintiff there? A. No.

Cross examined under reserve of objection.

By Mr. C. J. Brooke:

THE FAILURE OF THE GREEN PROSPECTUS AND THE PHOSPHATE TRUST.

Q. A short time before the General Phosphate Corporation was formed, were you instrumental in getting up the company known as "The Phosphate Trust?" A. No; we attempted to form a company by that name.

Q. Whom do you mean by "we?" A. Myself and some other gentlemen in London.

Q. You issued a prospectus to that effect? A. No.

Objection to this evidence as illegal and as not arising out of examination in chief. Objection reserved by consent of parties.

Q. Will you please look at the printed copy now shown to you, and will you state whether the same is not a prospectus of the Trust which we have just mentioned marked A 19? (the green prospectus of the Phosphate Trust) A. That is a copy of a draft of one of the drafts which were proposed, but which was never issued; you are asking me now whether this prospectus was issued. We printed about twelve rough drafts to try and negotiate the formation of a Trust, to organize this trust, but we were not able to carry out the intentions which we had then. It was only waste paper; it is not a prospectus.

Q. But it was intended to be a prospectus? A. Yes; if the thing went through.

Q. Did you have any conversation with the plaintiff concerning the Phosphate Trust or the General Phosphate Corporation? A. Yes; several conversations with him.

Q. When did you have these conversations with him? A. I believe that it was about the month of November or December, 1889, or the month of January, 1890.

Q. About what time was it that Exhibit A 19 was drawn up? A. At the end of July or the beginning of August, 1889.

Q. At that time there was a large quantity of phosphate lands for sale? A. Yes.

Q. And you as a broker had very many of these lands, these phosphate lands, under your charge for sale? A. Yes; not as a broker, but as an agent.

Q. As a commission agent? A. Yes.

Q. What made you choose, out of all those properties, what made you select the Stewart property? A. The reports of the experts that were given to us were principally the reason why we chose them.

Q. To the reports of what experts do you refer? A. To the reports of Mr. Wills and Mr. Attwood, and several others, of whom I don't remember.

Q. Are you positive that Mr. Attwood had at that time made a report of the Stewart property? A. No; he had not made a report on the Stewart property. I am speaking of the other properties which the Corporation bought.

Q. Therefore it was the report of Mr. Wills which chiefly led to the purchase of the Stewart property? A. It is very probable; I don't remember that any others reported on it. There were two or three experts who reported on other properties.

Q. Did the plaintiff see you in connection with the Stewart property?

THE EARLY HISTORY OF THE CORPORATION.

A. Perhaps I might explain it a little better: The plaintiff was introduced to me by a friend in London about the month of November, 1889, I believe, and it was at the time that we wanted to make this Phosphate Trust, and we had scheduled sixty thousand acres of phosphate land. A conversation took place between ourselves during which I proposed to the plaintiff with the object of employing him as an expert to report on properties which the Corporation might buy, and we agreed upon that; we even agreed upon the terms which were to be paid. I believe that we were to employ the plaintiff to choose those properties, to know what properties were worth buying for the Corporation. The organization went along, and in January or February the plaintiff left, and some time after that we all abandoned our efforts to form that company or trust. The idea of organizing was, that all the vendors should become the promoters, and should contribute towards promoting the company. There was some objection, and when I found that out, I took the organization of the General Phosphate Corporation, and in the month of May, 1890, the plaintiff came back to England, and when I saw him I agreed to recommend him as engineer to the General Phosphate Corporation; and afterwards I looked upon him as the engineer of the General Phosphate Corporation and as agent for the sale of lands. That was two or three months before the General Phosphate Corporation was put on the market; when the Corporation was organized, and when it was ready to name its engineer, I recommended the plaintiff to the Corporation, and he was appointed engineer to the corporation.

Q. Therefore, I understand that during the latter part of the year 1889, and the beginning of the year 1890, that the plaintiff was co-operating with you for the formation of a company towards the end of buying out Mr. Stewart? A. No; there was not much influence.

Q. How often did you see the plaintiff at that time? A. We met together several times.

Q. Why did you meet together? A. To discuss phosphates in general.

Q. Did you have any conversation with the plaintiff as to the directors of this new company which was to be formed!

Objected to this question as illegal, and as not arising out of the examination of the chief. Objection reserved by consent of parties.

A. It is very probable that I must have spoken to him about it as far as the directors were concerned, but I cannot say.

Q. That is to say the directors of the General Phosphate Corporation? A. It is very probable that I spoke to him about it; we had some general conversations.

Q. Is it not a fact that you had several conversations with the plaintiff, and that you discussed with him whom you would have as directors? A. No; I don't believe so; I know that I spoke to him as to who were going to be directors of the company, but I am sure that he did not know who was going to be directors. The one who helped me to organize the board was Mr. Mallaby Deeley.

Q. Is it not a matter of fact that in connection with this matter the plaintiff introduced you to Sir Charles Tupper with the object of having his name as a director?

Objection to this question as illegal. Objection reserved by consent of parties.

A. The plaintiff introduced me to Sir Charles Tupper.

Q. Did you request Sir Charles Tupper to put his name on the board of directors?

THE GOVERNMENT OBJECTS TO SIR CHARLES TUPPER.

A. He had been requested to put his name on the board of directors before that, and the plaintiff had told me that he thought he would get him on the board; he introduced me to him, and he told me that he would be a director if the Government would allow him, and they refused to allow him to do so.

Q. How is it that Mr. Wills was making suggestions to you as regards Sir Charles Tupper, if you state that he was not co-operating with you in this matter? A. Let me tell you that if I had the least idea that the plaintiff had any monetary interest to sell in these properties that it would be impossible for me to have recommended him as engineer to the company; and all the properties which the plaintiff recommended to me, I accepted them with the view that he would be engineer for the company; and he assisted me only in the view of seeing the company organized, and as far as I was concerned, that he would be named engineer.

SANDO DOES NOT WORK FOR NOTHING.

Q. As to your commission from the General Phosphate Corporation, did the General Phosphate Corporation know that you were getting this property for £29,000 whilst they were paying £40,000. A. No; my company knew that I was receiving a commission but the amount was never stated.

Q. You were receiving about twenty-seven per cent.? A. I. do not work for nothing. There are some companies, or parties, which receive one hundred per cent. on sales of properties to companies.

Q. Can you give us a statement of the securities which you received from the General Phosphate Corporation, through the plaintiff, as the £60,000 of purchase price to which you have referred, and of the amount which the securities realized, and the expenses which were incurred on their realization? A. Not more than I have told you.

Q. If the defendant said that he had received £7,600 on these £20,000, would you contradict him? A. I said that the net realization would not realize more than £6,000 in addition to the £1,000 cash; it may have realized more than that, but I do not remember; I am speaking from memory. I was not subpœnaed to bring my books here, and I cannot speak about all the accounts.

Q. Was the plaintiff aware of this agreement between the defendant and yourself as regards the £29,000? A. I have not the slightest idea whether he knew it or not.

Q. Are you aware that the defendant made an agreement after that with the General Phosphate Corporation by which he compromised this undertaking of his to get out 10,000 tons of phosphate? A. Yes.

Q. When you stated that you believed that he had only received £16,000 in all, did you take in consideration the amount which he received from the corporation under this last agreement? A. No; the two transactions took place 18 months apart.

Q. You know that the defendant received a large sum in shares of the General Phosphate Corporation? A. I do not know exactly the amount which he received in shares; I had nothing to do with the negotiations of that part of the proceedings. I should have added that that part of the negotiations took place before I was named director, and therefore it was only hearsay.

Q. What was the total amount which these £20,000 pounds of negotiable securities, mortgages, etc., realized? For how much were they sold? A. I believe £18,000, less £1,600 deducted and kept by the purchaser for the assurance premiums.

Q. And you yourself, took out of that £9,000 pounds? A. I took my balance, after having paid the expenses; I took my balance out of the £16,400.

SANDO ALSO POCKETS £11,000 STG. OF STEWART'S MORTGAGE.

Q. What was the balance which you took for yourself; what was the value of the expenses which you debited to yourself?

A. I do not remember; I figured on £11,000, less the expenses and the commission; I believe that I had about £1,000 of expenses, of legal expenses on it.

Re-examined under reserve of objections.

Q. To what legal expenses do you refer? A. To negotiate for the sale of the mortgage.

Q. As I understand the mortgage was sold for £18,000? A. Yes.

Q. And from this was deducted £1,600 for insurance premiums? A. Yes. There were two negotiations. On the first negotiation we were obliged to negotiate to assure the mortgage; there are some companies who assure mortgages; we were obliged to pay quite a large sum; we were obliged to pay for four years; this was a mortgage for five years, and after having negotiated the mortgage we negotiated the sale; if the company failed to pay the mortgage, the company would be obliged to pay, therefore it is very expensive; therefore after the assurance which we paid for one year, the insurance company charged the insurance premium for the following year during the balance of the mortgage.

Q. And that realized £16,400; that is to say, that left £16,400? A. Yes.

Q. Did you take £11,000 out of the £16,400. A. Yes; and I forwarded the balance, but keeping for myself a part of the expenses.

Q. What part? A. I do not remember; there were others which I considered as my own, and others which I considered as those of the defendant.

Q. What were these expenses? A. I had to pay the solicitor who came from Liverpool and who charged his work; the defendant paid the actual legal expenses for the transfer of the mortgage, and I was obliged to bear the other charges.

Q. That was independent of £1,600 which you paid for the insurance premium? A. Yes.

Q. Was the plaintiff appointed engineer for the company? A. Yes.

THE MANAGER'S SALARY.

Q. At what salary? A. £1,000.

Q. Did you consider that as a large salary? A. Yes; as a very good salary for a tip top man.

Q. When did you have this conversation with the plaintiff referred to in your cross-examination; was the plaintiff then acting as agent of the defendant? A. Not that I am aware of.

Q. Did he speak to you as agent for the defendant? A. Certainly not; otherwise I would not have recommended him to the Board.

Q. Did he seem to take more interest in Mr. Stewart's property than the one which the one which the corporation purchased? A. Not that I am aware of.

Q. In the figures which you have given as to the amount which the defendant realized, though you cannot give the figures, the exact figures, would you be out of £200 or £300 anyway?

Objected to this question as leading.

A. I am speaking from memory and I believe I would not be very much out.

Q. Did you ever pay the plaintiff anything yourself for any services which he ever rendered you personally in connection with the transactions which you were carrying on?

Objected to this question as illegal. Objection reserved by consent of parties?

A. I believe that I paid him £100 for certain expenses, for travelling expenses.

Q. In connection with what property? A. For any property in general, and for information which he furnished me personally.

Q. Relative to the sale of phosphate?

Objected to this question as illegal and as not arising out of the cross-examination. Objection reserved by consent of parties.

A. He was keeping me posted as to the standing of the mines, as to the samples which were found on various properties, and on the phosphate industry in Canada in general.

THE CORPORATION'S STOCK NOT WORTH MUCH.

Q. Was the stock of the company ever listed? A. No; it cannot be listed until two-thirds of the issued capital be subscribed.

Q. Can the shares be sold until it is listed; can any purchasers be found? A. Yes, often; but I do not say that we could sell any of the shares of this company at a good price, because the phosphate market is certainly down on account of the boom in Florida.

Q. Do you believe that a mortgage on these properties could be sold now for the net amount which you realized? A. No; certainly not.

Q. Did these transactions in connection with the arrangements which took place between the defendant and the General Phosphate Corporation take place recently—or when did they take place—as to the forfeiture of the £10,000? A. I believe in November, 1891.

Q. Do you know whether this forfeiture had been completely incurred with the company when this understanding was reached? A. The defendant acknowledged his inability to carry out the contract as I understand.

Re-cross-examined:—

Q. The time for getting out the phosphates was extended? A. That was part of the re-arrangement.

Q. Is it not a fact that the agreement by which the defendant received a sum of money and shares in settlement; is it a fact that the agreement had not taken place before this extended delay had expired. A. No.

Q. Are you positive as to that? A. No; not positive. The original twelve months expired only last April. This re-arrangement of terms was made in November last, by which the defendant surrendered his contract; therefore the extended time would be expired just now.

Q. Therefore, if defendant had continued to work at the mine, he would have had up till about November to carry out this contract? A. Yes.

Q. But this agreement terminating, it took place when? A. The first termination took place on the first of March last.

Re-examined anew:—

Q. Was there any possibility on the part of the defendant to distribute that amount of phosphate? A. No.

Q. 10,000 tons in a year? A. Yes.

Re-cross-examined anew:—

SANDO A GOLD MINER.

Q. Are you a mining hand yourself? A. Yes.

Q. Have you been engaged yourself in phosphate mining? A. No; in gold mining.

Q. Did you ever visit the mining lands in question? A. Yes.

Q. When? A. Two years ago last spring.

Q. If you have had no experience in phosphate mining how can you say that it was impossible for the defendant to carry out his contract for 10,000 tons? A. Because at the time the defendant abandoned his contract there was only one month to the end of the original term mentioned in the contract; during that time he had got only 3,000 tons, and therefore he could not deliver 7,000 tons in one month.

A chimney 350 feet high is being built for the Omaha and Grant Smelting Works, in Denver, Colo. It will be an octagon stack, 55 feet in diameter at the base, placed on a concrete foundation 18 feet deep, embedding 20 tons of steel rails. There will be two stacks, one within the other, with a ladder-way between. The stack will be banded with 4½ inch wide steel bands every 20 feet, covered by the brick work. The contract price is about $53,000, and it is to be finished in 130 days.

The Sydney and Louisburg Railway and Coal Company.

The Directors Report a Large Output and Heavy Expenditures at the Mine. Something Wrong.

In view of the comments elsewhere on the operations of the Sydney and Louisburg Coal and Railway Company, we reproduce below the proceedings at the last annual meeting of shareholders, held in London on 1st July.

OUTPUT INCREASED TO 170,863 TONS.

The CHAIRMAN (Mr G. W. Medley)—Gentlemen: You have had the report and accounts, and I presume we may take them as read. You will see that last year we raised 170,863 tons as against 155,907 in 1890, and 121,660 tons in 1889. That is the largest quantity ever raised by this company, and under ordinary circumstances we should have had a very fair profit to show, but owing to causes which I shall tell you about, the anticipated profits though made could not be kept in the coffers of the company, but had to a large extent to be disbursed. I will now tell you how that came about. In the first place the general repairs and construction cost £1,328 more than in the prevous year, and the reason is this—there was an accident to the Sydney Pier in April, 1891, from a heavy impact of running ice. Of course repairs had to be made, but the outlay was increased by the discovery of a large amount of dry rot in the timbers of the pier. A report was obtained from the provincial engineer, and the repairs were effected as far as could be done, but there is still some small work to do on this account. Then we had to meet a rise in wages of £1,200. A demand had been made from the working miners in Cape Breton for an increase of wages, in some cases amounting to 15 per cent. on all the collieries. That was 6 cents, or 3d. a ton, but negotiations resulted in this, that a concession by all the collieries was made to give 3c., or 1½d., or 7½c. per ton. Then we have the heavy item of £439 for new piping for water supply. The supply of water at the mines was failing, and increasingly so year by year. The Emery water was found unfit on account of its vicious action on the boilers, besides being insufficient during the summer months and having to be hauled by carts, and a Fox-Walker locomotive. A heavy charge was involved, and the conclusion was come to to lay a 3-in. pipe for 3,200 ft. from a brook giving a supply, which was continued to where the Emery boilers were placed. These three sums, gentlemen, make a total of £2,967 off the year's profit. But as the report tells you, there were other charges on the revenue of the year. The first to which I shall call attention was £1,968 by way of depreciation. £1,762 was charged as shown in the statement presented last year, but as you are now aware we are acquiring a fresh coal area, having to a great extent exhausted one of the areas now in our possession. We bought that new area for £3,000, and the payments for it are spread over five years, about £600 every year. We are writing off one third of all the payments we make until the whole of that £3,000 is exhausted, and if we add to the £1,762 of which I have told you £206, a third of the £600, you will find that comes to about £1,968 for depreciation, as shown in the accounts. Then that £1,762 arises from our writing off the payments on account of the stone drift and the new cars. This is the second year that amount has been written off. After that this charge will disappear from the accounts. Then, again, we, in extending our operations, opened up the Emery Mine, and £845 is charged against revenue account this year for that. That also is a charge which has been spread over three years, and after the current year, that is to say, 1892, payments on this account will also cease. These two charges of £2,813 and £2,967, make a total of £5,780 against this year's revenue account, which will fully account for the small balance left of £1120 Then the question is, what are we to do with that amount. Of course, we wish to divide it in the shape of a dividend, and, adding it to the amount brought forward last year (£554), we are enabled to pay 5 per cent., and absorb £1,500 of the £1,670, which stands at the credit of revenue account. I need not say that we had hoped for better things, but that is exactly the state of the case, and I am afraid that for this year we shall not be able to propose a larger dividend. In all the business that has gone on on the other side, I must take the opportunity now of paying tribute to the great attention shown to our interests by Mr. Kennelly and the staff under him. As regards the board, since we last met we have had to deplore the death of our esteemed colleague, Mr. Bernard Schroder, who died in December last. Some time ago the board elected Mr. Edmund Arthur Smith, who sits now at this table as a director in place of Mr. Schroder, and I shall have to ask the meeting to confirm that gentleman's election. The retiring directors are Mr. Mills and myself, and, being both eligible, we offer ourselves for re-election. The auditor, Mr. John Paterson, also offers himself for re-election. With regard to

THE PROSPECTS OF THE CURRENT YEAR,

they have to some extent been clouded by the erratic conduct of at least one of our competitors in marketing coal at prices considerably lower than those which ordinarily rule in the Canadian market, but I would rather not refer further to this than to say that these companies have gone their own way in the matter, and must be considered to know their own business bes , How their action will turn out as regards themselves, r ourselves, it is at the present moment a little prema .re to say. There is, however, a more serious matte to which I must draw your attention, and that is the recent action of the Provincial Government in obtaining an Act of Parliament enabling it to raise the royalties on minerals.

THE INCREASED COAL ROYALTY.

The proposition for it came as a surprise upon us, and all the other mining companies of Nova Scotia. Of course, there were remonstrances from them. There were disputes over the terms of the leases. The Government refused to take either judicial opinion by a test case before the Courts, or to arbitrate, though the Hon. Mr. Fielding, the Provincial Secretary, had more than once declared that "he did not propose to invoke the powers of the legislature, but only to exercise the rights under the leases." Legal opinion was also taken of prominent lawyers, and that opinion was that the legislature had not, as a matter of contract, any right to revise the leases, and there was a general consensus of opinion that the Supreme Court would decide in favour of the lessees. The result of it all was, as you have heard, that the Government had to fall back on its rights to break contracts by legislation, and so a retrospective act was passed. That act, I understand, raises the present royalty on coal of 7½ per cent. per ton to 10 cents, until 1906, and then to a rate not exceeding 12½ cents to 1926, and then the rate is to be at a figure not yet agreed upon for the remainder of the leases, that is, until 1946. I need hardly say that this high-handed action has

CAUSED THE GREATEST DISSATISFACTION

throughout the province, and also a very uneasy feeling. It has acted as a damper on enterprise, and is, no doubt, calculated to injure the trade and prospects of the province. I understand that Mr. Hawkins is to move a resolution on his own account. My own opinion is that the board is generally disposed to agree with him, but to carry his motion bristles with legal difficulties and impossibilities, so that with all the willingness in the world, we should simply find ourselves powerless to meet his views. It is very near the hearts of the directors to do something with the arrears, but questions of circumstance and principle come in, and we think this is not an opportune time for taking action. Of course, some arrangement would be facilitated, if not altogether guaranteed, by our being able to dispose of our railway, but circumstances have militated against that. We have taken the precaution to ask our legal adviser to be present, and he will be able to tell you a great deal more about the difficulties or impossibilities of carrying into effect Mr. Hawkins' view. I now move "That the directors' report and accounts as submitted to this meeting be approved and adopted."

Mr. J. G. MILLS (director) seconded the motion.

SHAREHOLDERS' GRIEVANCES.

Mr. HAWKINS: I have no doubt the directors will thoroughly understand that my resolution has no hostile intention towards them, but is simply designed to ventilate the subject of the grievances of the poor ordinary shareholders. It seems to me we have a company here which, on the face of it, is earning about £7,000 a year, and the total capital, according to the market prices of the Stock Exchange, is £150,000. To earn that we seem to spend about £4,000 a year. I have no doubt the items the chairman has explained as to increases of wages and repairs can scarcely be guarded against, but I do not understand whether they come under expenses at Cape Breton. The London expenses (£920) make a total expenditure of £4,000. I see the coal account shows a profit of £6,795, and the small amount of goods and passenger traffic, rent and interest about clears the shipping charges. It seems to me that these expenses are heavy. I have no doubt the difficulties are serious, and that it is rather impertinent to ask men who have been receiving 10 per cent.on their preference shares to reduce their rate of interest, but they must remember that in the event of a break up they have no prior lien, and would simply share with the ordinary shareholders. If, therefore, they reduced their interest 5 per cent., and had that as a first charge, they would have a much better security, and we should have a chance of getting a small dividend. It would also, in the event of more capital being required, be much easier to raise it Still on the balance sheet put before us my ideas have been modified, as my contentions were based on the balance sheet of the previous year. As far as the output has been concerned, we have realised the point of prosperity indicated a year ago, but we have not made the desired profit. I think it would be better not to persevere with the resolution, but to leave it to the directors to see if anythimg can be done in the future to fund these back coupons, if possible, and make them enjoy a 5 per cent. dividend or something like that, and then we should get rid of the millstone about our necks. I beg to withdraw my resolution.

THE LEGAL OBSTACLES.

Mr. SLAUGHTER: The point is very simple. The regulations of the company determine the rights of the different shareholders, and one of them is clause 104, "That no dividend shall bear any interest against the company." Mr. Hawkins' proposal was that the back dividends on the preference shares, which are cumulative, should have been, so to speak, funded to bear interest, and be disconnected from the shares, so that all you require to be done out of current revenue would be not to pay arrears of dividend, but with the balance to pay a dividend upon the ordinary stock. I have only carried out one operation like that, and was under the necessity of applying to Parliament for leave to do so. We acted under advices of Sir Horace Davey, and found we were bound to go to Parliament, and there appears no conditions in our memorandum or articles of association to give us the required power. No doubt one could issue deferred dividend warrants payable out of a particular fund, but that alters the memorandum and articles in such a way that you cannot legally carry any such alteration into effect without the sanction of Parliament. It comes to this, that what Mr. Hawkins intended to propose, which seems very desirable (though I have not yet had any conference with the board), it was impossible to carry out, unless you promote a Bill in Parliament for the purpose of getting the necessary legal powers to do it.

The motion was carried unanimously.

ROUTINE BUSINESS AND THANKS.

The CHAIRMAN proposed, "That a dividend of 6s. per share on the 5,000 first preference shares be paid on or before the 1st Oct. next to such shareholders as are on the register at this date."

Mr. RUSSELL seconded the motion, which was carried unanimously.

The CHAIRMAN proposed, and Mr. Mills seconded, the election of Mr. Edmund A. Smith as a director, and it was agreed to.

Mr. MILLS proposed, and Mr. Brydone seconded, the re-election of Mr. G. W. Medley as a director of the company, and it was carried unanimously.

The CHAIRMAN proposed, and Mr. Smith seconded, the re-election of Mr. Mills as a director of the company, and it was carried unanimously.

Mr. BRYDONE proposed, and the Rev. B. P. Thompson seconded, the re-election of the auditor, Mr. John Paterson, at a remuneration of 20 guineas, and it was agreed to.

Mr. DOUGHTY BROWNE, in proposing a vote of thanks to the chairman, pointed out that the duties of the board, when the company was not going smoothly, were much more onerous than when it was going well. (Hear, hear.)

The motion was seconded and carried.

The CHAIRMAN returned thanks, and quite endorsed the remarks that Mr. Browne had made.

The Sydney and Louisburg Coal and Railway Co.—That "Impact of Ice" Flatly Contradicted from an Official Source.

We do not suppose that our readers believe that we are so foolish as to make statements seriously reflecting upon the management of the Sydney and Louisburg or any other company, without careful enquiry and ample proof that our charges are as stated. One of the results of a careful investigation into the company's affairs in Canada, has been to elicit from the secretary of the Sydney Board of Trade a flat contradiction to the statement contained in the directors' report of material damage to the Sydney and Louisburg pier entailing heavy expense through an impact of ice. Indeed we understand that at the next meeting of the Board resolutions will be submitted repudiating the libel and condemning the action of the directors in giving to the public a report so hurtful to shipping interests of the port. The following correspondence, being but a small portion of the evidence in our possession, will be read with interest :—

VICTORIA CHAMBERS, WELLINGTON ST.,
OTTAWA, October 10th, 1892.

J. A. Gillies, M.P.,
Sydney, C.B.

DEAR SIR,—I notice in a recent issue of an English financial paper some reference to an impact of ice which created considerable damage to Sydney Harbor last winter.

May I ask if you can inform me of the date of the occurrence and the extent of the damage done? An early reply to this enquiry will greatly oblige.

Thanking you in advance for this courtesy, believe me,

Yours very truly,
B. T. A. BELL.

SYDNEY, C.B., October 14th, 1892.

B. T. A. Bell, Esq.,
Editor Canadian Mining Review, Ottawa.

DEAR SIR,—I am in receipt of your favor of the 10th instant inquiring as to the damage done to Sydney and Louisburg pier by impact of running ice during the winter of 1891. In reply I beg to enclose you a letter under date 31st August addressed to me upon this subject by Mr. A. G. McLean, the Secretary of the Cape Breton Board of Trade. You will perceive that Mr. McLean's letter covers the ground of your enquiry.

Yours truly,
J. A. GILLIES.

SYDNEY, C.B., August 31st, 1892.

J. A. Gillies, Esq., M.P., Sydney.

DEAR SIR,—Yours of the 27th inst. to hand and noted. I was not aware that any damage had been done to the Sydney and Louisburg Coal and Railway Company's pier until I saw the report of the company's agent to that effect in some of the newspapers. I have made enquiries of several reliable and competent citizens of this town, and they all assure me that no such damage as reported has been done in the harbor of Sydney through an "impact of ice." They say further, that such a report is a gross libel on the fair name of our magnificent harbour.

Yours very truly,
A. G. McLEAN.
Secretary C.B. Board of Trade.

Coal Washing by the Luhrig Process.*

By Walter J. May.

Possibly there is no process of coal washing which is arranged the same as that of Mr. C Luhrig, and certainly no process can be arranged where the whole output of the mine is dealt with by the one process, as by carefully designing the machinery all unnecessary labour is avoided. The process is a simple one, and, like most simple processes, is very efficient. The whole process is simply the grading or sizing of the coal, the separation of each grade into pure coal, coal and tailings, and pure tailings (the second or intermediate result only being crushed to separate the waste), and thus a lot of both mechanical and manual labour is saved. In nearly all other systems of coal washing, the whole of the coal is crushed and afterwards washed, thus reducing everything practically to one size before beginning to separate it. This may act well, but when it is considered that what is to be removed from the coal is usually well defined in bands or separate pieces, the necessity for crushing everything does not exist, while power is wasted and the capacity of the machinery reduced.

Probably, coal will average about 2·16 per cent. to 3·20 per cent. in ash held in combination with the coal, but in many samples of manufacturing coals—and here we take from cobbles downwards—the percentage of ash and waste will be as high as 15 per cent., and with careful treatment in washing, this can be reduced to the normal average of the coal without undue breaking, as a rule, as coal under 4-inch cubes are usually fairly clean in part, while that under 2-inch cubes will be cleaner still, the dirt, or shale, or brasses being dissociated from the coal to a very great extent, although the whole will be mixed together. The actual separation now will be simple, after sizing, and the dirty stuff would need little crushing to separate the last portions of coal. Taking a coal with, say 4 per cent. ash and waste, in buying 100 tons, we obtain 96 tons of effective heating material, whereas if 14 per cent of ash and waste has to be dealt with, we only obtain 86 tons of heating material for which we pay the cost of 100 tons. To assume a case we will suppose a coal in all charges put into the furnace costs 10s. per ton, and that handling the ashes and waste all charges will come 1s. 6d. per ton, and this will work out as follows:—

	£	s.	d.
100 tons coal at 10s	50	0	0
Handling 4 tons ashes and waste at 1s. 6d.	0	6	0
	50	6	0

Effective fuel for heating, 96 tons costing 10s. 5¾d. per ton net.

100 tons coal at 10s	50	0	0
Handling 14 tons ashes and waste at 1s. 6d.	1	1	0
	51	1	0

Effective coal for heating, 86 tons, costing 11s. 10·465d.

This gives an actual money increase of 1s. 4·715d. per ton, or in the case of a place burning 25 tons of either sort of coal only per week, the poorer coal would cost actually per year, £90 10s. 9½d. more in proportion to the work done than would be the case with the one that was freest from ash.

Putting the matter another way, and assuming that 25 tons of coal giving 4·0 per cent. waste just effects certain work, we find that in fifty-two weeks we use so much coal and move so much ashes, and taking preceding assumed cost for the sake of comparison, of the better coal we use 1,300 tons and handle 52 tons of ashes and dirt, the total cost being £653 18s. This coal has an efficiency of 96 per cent., and if we take the poorer coal with an efficiency of 86 per cent., we shall want more coal, and also have to move more ashes, and the coal in such case should cost less per ton. In fact, it would require 1,451 tons to do the work of the 1,300, and instead of handling 52 tons of waste we should have to deal with 203 tons. The price for this coal should be only 9s. 0·145d. per ton, but usually neither purchaser nor vendor makes the waste a matter of consideration. Clean coal is the cheapest in the end, and should always be insisted on, as there is neither rhyme nor reason in using dirty coal.

So far as the Luhrig process is worked in this country, no doubt the plant at the North Motherwell collieries of Messrs. Merry and Cunninghame may be taken as being fully representative of the process now under discussion. In this plant about 1,500 tons of coal—as raised—is treated daily, and this is brought to a platform by means of rope drives, and here the hutches or corves are discharged by means of tipplers on to vibrating screens of metal plates with round holes of about 2in. diameter, and all that passes these screens is washed, while the large passes on to picking tables, in which the ordinary plates are replaced by round rods having spaces between them, through which the dirt and small coal can pass, when dislodged, in dressing the large coal. This dry separation plant is in a separate building to the wet plant and in addition is worked by a separate engine so as to be independent of the wet plant As the coal passes over the tables, stones and dirt are picked out, and the shale is chipped off any pieces where necessary, while the clean coal is delivered into waggons by the belt, which has an adjustable arm and is raised or lowered as required to prevent breakage of the coal as it falls into the waggon. In the sorting, clean stone and dirt free from coal is taken directly to waste and is done with, but coal combined with shale or stone is taken to a coal breaker to be broken up for further treatment, and is carried back to the other dirty coal or dross.

Coming now to the wet separation, the whole of the dross is elevated to the top of another building, and at once delivered into a revolving drum, which sizes into nuts, beans, peas and dust, and from this drum the different sizes are conveyed by shoots to jigs, in which the coal is separated into three classes—(1) clean coal, (2) coal intermixed with shale or brasses, and (3) dirt free from coal. Only coal above ⅜ in. is treated in these jigs, which are of special design, and made to treat large quantities. The waste is taken away to the pits by means of spouts, and the clean coal is taken over drainers into hoppers for loading, while the intermediate stuff is elevated to the top of the building to be crushed in a roller mill, and from here it passes to the proper jigs to be again separated. The fine coal from the sizing screens under ⅜ in. passes with the overflow water from the nut coal jigs to special grading boxes, and from these it passes to jigs with suitable meshed grids, having felspar beds, and is there thoroughly cleaned, the dirt being taken to the pits, and from thence lifted to waggons for removal by means of an elevator, while the clean coal passes into a draining drum, whence the water and fine coal are taken to a sludge pit, and the pearls are conveyed to large storage hoppers. From the sludge pit the fine coal is collected by means of a patented sludge-recovery apparatus and lifted by an elevator either into separate hoppers or into the pearl coal hoppers, according to the use it is to be put to. Roughly this is the whole process, and the cost for labour in washing is practically ½d. per ton, and at Motherwell the ash is reduced from 23 per cent. to 2·5 per cent.

At Ellenborough Colliery, Maryport, a sample of the small coal held 13·78 per cent. ash before washing, and the pearls after washing 2·78 per cent., while the pearls and sludge mixed after washing 4·14 per cent. ash and 0·85 per cent. sulphur; 52 tons 13 cwt. treated for this result gave 46 tons 8 cwt. coal, and 6 tons 5 cwt. waste, in which there was 2·8 per cent. of coal, while the proportions of the cleaned coal gave 86·48 per cent. pearls and 13·52 per cent. sludge. Another sample of coal at the same colliery gave before washing 5·24 per cent. of water and 22·41 per cent. ash, while after washing, water stood at 4·94 per cent. and ash 4·48 per cent.

In a Scotch coal treated, the percentages of clean coals gave 41·84 per cent of "treble" and "double" nuts worth 7s. 9d. and 6s. 9d. per ton f.o.r. mine, 30·61 per cent. "single nuts" worth 4s. 6d. per ton, 10·21 per cent. "peas" worth 3s. 9d. per ton, and 17·34 per cent. "sludge" worth 3s. per ton. Before washing this was a very dirty coal but now the ash hardly exceeds the fixed ash by a figure in the second decimal place, while instead of being worth from 6d. to 8d. per ton, it will run out over 3s. 6d. per ton on the crude.

Possibly the wetness of the washed coal will be objected to, but this wetness does not exist, as except with the sludge the water drains off very readily, and having had washed "peas" from Scotland the writer can say that the water was no trouble, but peas are too small for all boilers, and this occurred in the case of the boilers referred to. Nuts and beans, or all sizes above, say, ⅜ in. cube should dry in a very short time when exposed to the air in waggons, and the cost of this detention would not be much.

For coking purposes the washing of the coal gives good results, and at the Ellenborough Colliery, Maryport, where the coal was regarded as non-coking prior to the erection of washing plant, good cokes have been produced, and the following will show what results are obtained. Slack before washing contains 22·41 per cent. ash, and after washing pearls (air dried) show 4.48 per cent. ash, pearl and sludge (air dried) 7·38 per cent. ash, and sludge (air dried) 11.90 per cent. ash. Now, taking these in the same order, pearls gave 50·72 per cent. coke, carrying 8·10 per cent. of ash; pearls and sludge, gave 53·05 per cent. of coke, carrying 13·40 per cent ash; and sludge gave 51·52 per cent. coke, carrying 17·44 per cent. ash. Of course, this is not an average, and to get this it is necessary to take the average for some months, and if we take that of the coke made at the Maria-Anne and Steinbank Collieries, Bochum, Westphalia, it will be found that the average ash for March 1880 was 47·45 per cent., the highest being 5·031 per cent. and the lowest 4·099 per cent., while an average for the nine months ending March 31, 1880, gave a daily result of 4·7815 per cent., the lowest monthly average being 4·575 per cent., and the highest 5·096 per cent., the difference being 0·521 per cent. only, which shows how level and uniformly the process works. The percentage of coke to coal is not given, but assuming it to be 50 per cent., we get only 2·39 per cent. ash in the coal before it is carbonised. Prior to washing plant being put up, the coke carried 10 per cent. ash.

Pyrites or brasses, when sufficiently plentiful, can be saved, and are worth varying sums, according to their content, in some cases being sufficient to pay for the whole of the working expenses; but in any case they are worth separating, if in anything like appreciable quantities, but if not, then they can pass away to waste.

Coming to the cost of washing, we have to take all costs and charges in connection with the process, and then to this we have to add the loss in bulk, when this is worth anything. Take, as an instance, a crude slack, worth, in its dirty state, say 2s. 6d. per ton at the pit, and which contains everything under 1 in. Now the possibility is that quite 20 per cent. of separable waste exists in this, and that the clean coal would contain nuts and coal above ⅜ in. to the extent of 50 per cent., the balance being coking stuff. Taking, say, 100 tons of this, we get a value of £12 10s. for the crude to start with, and, as we lose 20 per cent. in bulk in the waste, this brings the average of the coal saved to an original cost of 3s. 1½d. per ton. Assuming that the nuts and beans are in equal quantities, and worth, respectively, 5s. 6d. and 4s. 6d. per ton, and that the coking stuff is worth 3s. 6d. per ton; we get as follows:—

	£	s.	d.
40 tons coking coal (pearls and sludge), at 3s. 6d	7	0	0
20 tons peas or beans (⅜ in. to ⅝ in.), at 4s. 6d.	4	10	0
20 tons nuts (⅝ in. to 1 in.), at 5s. 6d.	5	10	0
	17	0	0

Taking the Luhrig Company's own maximum estimate of $\frac{8}{10}$ of one penny per ton for dressing, we get 6s. 8d. as the cost of dressing only, but as there are other charges incident to all machinery which may well be taken as raising the charges to 3d. per ton on the crude, this gives £1 5s. as cost of dressing, and the account would stand then as follows:—

	£	s.	d.
To 100 tons coal at 2s. 6d.	12	10	0
" Dressing, all charges, at 3d.	1	5	0
	13	15	0

Against this we have 80 tons sold and used as under:—

	£	s.	d.
By 40 tons coking coal at 3s. 6d. per ton	7	0	0
" 20 tons peas at 4s. 6d. per ton	4	10	0
" 20 tons nuts at 5s. 6d. per ton	5	10	0
	17	0	0

This gives a net profit of £3 5s., and if 200 tons per day were treated for each of 300 days per year, we should get £3 5s. + 2 + 300 = £1,950 per year net profit, besides having to provide waggons for 12,000 tons less coal, which would be equal in working to five 10-ton waggons daily, hence the saving in waggon repairs would be considerable.

Naturally, every plant erected will have to meet the requirements of the variety of coal dealt with, and the purpose for which the clean coal has to be turned out, and this prevents any hard and fast lines being laid down either as to cost of working or cost of erecting: but as some idea of these charges may be worth having, it may be taken that an average cost for erecting plant for handling 1,000 tons per day would be £9,000, and the annual charges would be practically as follows:—

	£	s.	d.
Depreciation 10 per cent £9,000	900	0	0
Interest at 5 per cent. on £9,000	450	0	0
Repairs	20	0	0
General charges, say	380	0	0
Steam, wages, stores, process, &c., at 1½d. per ton	1,875	0	0
	3,625	0	0

On 300,000 tons this is equal to 2·9d. per ton, but even allowing the cost to run out to 3d. per ton or £3,750, there is a good margin for profit, as clean coal will always sell where dirty coal will not.

For instance, at a certain works, 28 tons of coal (slack) was the weekly average consumption of 30 weeks, not more than 6 per cent. of waste coming from the hoilers, and keeping an average pressure of steam of 50 lb. (the man in charge of the boilers was fined 2s. 6d. if the boilers blew off steam at 53 lb., or if pressure sank below 47 lb., and the fines were sharply enforced). This slack cost 13s. 9d. delivered, and averaged about 20 cwt. 42 lb. to the ton. Well, there was a new manager, who, of course, had new trades people, and he had a new coal, and this new coal was "screened nuts," at 12s. 6d. per ton for 21 cwt. net delivered; 98 tons were delivered, and lasted eleven days to keep up the steam needed, an extra man being put on to help the ordinary stoker, as over 40 per cent. of waste was produced (the actual weight being 39 tons 19¼ cwt.). The coal was good, what there was of it in a clean state, but in an unclean state it was little better than shale, and its value may be taken as follows:—28 tons of slack, plus 10½ cwt., cost £19 5s., which gives the price as 13s. 5.96d. per net ton, and in eleven days 44 tons would have been used on the average, and would have cost £29 13s. 10.24d. On the other hand, 98 tons plus 98 cwt., cost £61 5s., or 11s. 10.86d. per net ton, and to this must be added the extra labour, £2 4s. for the eleven days, which made the cost actually £63 9s. Compared together, the dear slack cost £2 13s. 11·84d. per day, and the cheap nuts £5 15s. 4·36d. per day. One experience of this kind was enough, and no more nuts were required, but had the nuts been clean, they would have been of more value as fuel than the slack, as sundry lumps which were analysed only gave an average of 1·031 per cent. ash.

A new mineral, not unlike asbestos in its properties, has been discovered in immense deposits in the United States of Colombia. It is stated to be the colour of amber, perfectly transparent, and incombustible. Experiments made at Bogota indicate that it will be of great value for the manufacture of bank-note paper, for fire-proof and water-proof roofing tiles, and for suits for firemen. A white varnish can also be extracted from it. The substance has been named bucara-manquina, and it is expected to prove of greater importance than asbestos.

* Colliery Guardian.

The International Mining Convention — Special Meeting of the General Mining Association of Quebec.

On Friday, 14th instant, a special meeting of the Council of the General Mining Association of Quebec was held at the office of the treasurer, Mr. A. W. Stevenson, 17 St. John St., Montreal. There were present: Col. Lucke, (Beaver Asbestos Co.), Sherbrooke; J. Burley-Smith, M.E., (British-American Phosphate Co.), Glen Almond: R. T. Hopper, (Anglo-Canadian Asbestos Co.), Montreal; J. Lainson Wills, F.C.S., Ottawa; O. M. Harris, Montreal: J. Keith Reid, Buckingham, Que.; A. W. Stevenson, C.A., Montreal; and B. T. A. Bell, Ottawa. There were also present: Mr. R. G. Leckie, Managing Director Londonderry Iron Company, Londonderry, N.S.; Prof. B. J. Harrington, Prof. H. T. Bovey, and Dr. Johnson, of McGill University. In the absence of the president, Col. Lucke was called to the chair.

MR. BELL read the following letter from Sir J. S. D. Thompson, Minister of Justice, with reference to a grant from the Dominion Government:—

OFFICE OF THE MINISTER OF JUSTICE,
OTTAWA, 13th October, 1892.

DEAR MR. BELL,—In repiy to your letter of 11th inst., I beg to say that the application of the General Mining Association of Quebec, has received a very favorable consideration, and that we will be prepared to recommend to parliament that an appropriation of one thousand dollars be granted, in pursuance of the request.

Yours sincerly,
(Sgd.) JNO. S. D. THOMPSON.

B. T. A. Bell,
Secretary,
Gen. M. A. of Quebec.

MR. BELL stated that the American Institute of Mining Engineers, the Mining Society of Nova Scotia, the Asbestos Club, and other Canadian bodies, had been approached with a view to holding an international conference at Montreal, and favorable responses had been received. The date suggested by Dr. Raymond as favorable to a gathering of the members of the American Institute of Mining Engineers, was the third Tuesday in February, but a few days later would not signify if the Council desired to hold the Convention at a later date. The idea was that the American Institute should hold its annual meeting as the guests of the Association, and that an International Convention should be held at the same time at which Canadian mining laws, mining practice, and the mineral industries of the Dominion might form the principal subjects of discussion. At the last meeting of the Institute, held in Ottawa, about one hundred ladies and gentlemen were present, but the time of year then was a busy one, and there was a strong likelihood that the attendance of Americans would be much greater on this occasion. With a strong representation from the provinces there should not be less than 500 present in February.

MR. BURLEY SMITH was heartily in sympathy with the proposed Convention, but he thought that the Government of the Province of Quebec, having already received direct benefits from the last meeting of the Institute, should also be asked to contribute a grant. He proposed that the president, (Hon. George Irvine, Quebec), the vice-president, (Mr. James King, M.P.P.), Col. Lucke, and the secretary, be a deputation to wait on the Government respecting such an appropriation.

MR. A. W. STEVENSON in seconding the motion, said he did not doubt that the City Council of Montrea would also do something for the visitors.

MR. R. G. LECKIE said he was pleased to hear that the Institute was coming again to Canada. Canadians attending the Institute's meetings in the States were always received with the greatest cordiality and hospitality. We should do everything possible to make the occasion a success.

DR. JOHNSON, on behalf of the University of McGill, said he had no doubt if the authorities were approached, suitable accommodation for meetings would be provided.

PROF. BOVEY referred to the reception given last year in the Engineering Building to the Electrical Engineers. He thought that a similar entertainment might be given at considerably less cost.

After some further discussion, full powers were conferred on the secretary to employ what help would be necessary to prepare a programme and make all arrangements. The following names were suggested as a Citizen's Reception Committee: Sir Donald Smith, M.P., Sir Joseph Hickson, Sir J. William Dawson, J. J. C. Curran, Q.C., M.P., Hon. Senator Murphy, Hon. G. A. Drummond, W. C. McDonald, E. B. Greenshields, Robert Cowan, W. R. Elmenhurst, R. B. Angus, Duncan McIntyre, Richard White, Hugh Graham, A. P. Paterson, J. H. R. Molson, John Kennedy, C.E., Mr. St. George, City Engineer, H. A. Budden, Hugh McLennan, Mr. Hannaford, Hon. Mr. Ogilvie, H. R. Ives, H. Beaugrand, D. L. Lockerby, C. Cassils, F. Redpath, Dr. Brainerd, Consul-Gen. Knapp, James Burnet, R. Blackwell, Jonathan Hodgson, Samuel Finlay, B. A. Peterson, H. R. Ives, F. C. Henshaw, Henry Bulmer, G. W. Eadie, Edgar MacDougall, Prof. Bovey, B. J. Harrington, W. A. Carlyle, R. McCall, and Dr. Johnson, with power to add to their number. The Council then adjourned.

The History of Mining in the Province of Quebec.*

J. OBALSKI, M.E., QUEBEC.

The mining industry in the Province of Quebec is relatively new, although since the first years of the colony the attention of the capitalists has been directed to that industry.

In 1590 we see that a mining license for copper, on the north shore of the Gulf of St. Lawrence, was granted to a nephew of Jacques Cartier. Under the French domination, in the seigniorial concessions, a notice had to be given to the King of the mines which could be discovered. Later on, under the English domination, it was stated in the letters patent that certain minerals were reserved. Nevertheless we don't see any attempt to develop the mines.

In 1837 the iron works of St. Maurice were established and they used bog ore of the neighborhood of Three Rivers. This essay was the first of that kind in North America, and we must say that it was successful, that industry still existing; and several blast furnaces having been in operation at different times and at different points of this province. There are actually three blast furnaces utilizing bog ore, two at Drummondville and one at Radnor. This last one was re-built last year and is actually in full operation, producing 40 tons of pig iron per day.

We don't hear much about mines until 1846, when the gold mines of the Beauce region were discovered. In the meantime a few explorations were made. The Geological Survey began its work. Apatite, then without value, was discovered in the Ottawa, petroleum in Gaspé Peninsula, and copper in the Eastern Townships.

In 1854 the Government regulated the sale of the mining lands, and stipulated that they would be sold at four shillings an acre.

In 1846 the Government granted a license for the working of gold in the Seigniory Rigaud Vaudreuil, covering about 70 thousand acres. The DeLery Gold Mining Co. is formed and begins work in the valley of the Gilbert River; gold is found in quantity in an alluvial form, the quartz being tried but without success; then the mining companies were troubled by the proprietors of the surface; law suits and riots were the result; the Government interferes and brings the whole before the courts, who decide in favor of the validity of the patent only in 1883. Unfortunately the result of all these troubles were to discourage the speculators and the miners, and that industry remained idle until now, when some essays are continued by enterprising men.

In 1864 the Government enacted the "Gold Mines Act of 1864," which determined the price of the gold mining lands, the right of the proprietors of the surface, and the conditions for the working.

Previous to, and about 1860, a great deal of prospecting for copper was done; in 1864 the value of copper reaching 59 cents a pound. Explorations were made with success in the Eastern townships, and a large number of mines were then in operation, and amongst them those of Harvey Hill and Capelton, which are still working. The explorations showed that the copper ores existed over a great number of properties. Many companies were then organized, but it is impossible to state what quantity of copper was extracted. Everybody knows that in the Eastern Townships there are two kinds of copper ores existing; 1. The rich ore, as the bornite and chalcocite, worked at Harvey Hill, but in relatively small deposits. 2. The low grade ore, as copper sulphuret, which is found in large bodies in many places and mainly worked for the present at Capelton. This last ore containing, over 40% of sulphur, 2% to 5% of copper, and a small quantity of silver, is principally used as a source of sulphur for the manufacture of sulphuric acid, and exists in large deposits, being sometimes over 50 feet in thickness. Then the variations of the price of copper don't affect much that industry. It is not the same for the high grade ore, which is found in much smaller deposits. If we consider that the actual quotation of copper is 17 cents a pound, it will be then understood that the attention is brought principally on the poor but more abundant ore. The Nichols Co. manufactures sulphuric acid and also super-phosphate and chemical manures by using the Ottawa phosphate. Now the annual production of copper ore for this province is about 80,000 tons, coming principally from the vicinity of Sherbrooke. Indications of rich copper ore, and also of native copper, were lately found in the County of Matane, but we have not yet heard any particulars about that discovery.

About 1865, borings for oil were undertaken in the vicinity of Gaspé Basin. A small quantity of oil was there obtained, but the works were abandoned until two years ago, when several borings at different points proved again the existence of petroleum in this district.

In 1867, the attention of some Quebec and Montreal people was brought on the magnetic land on the north shore of the St. Lawrence. A strong company was formed, and Chase Moisic selected as the headquarters of their operations. The sand was concentrated and smelted on the spot, charcoal being used as fuel, and iron obtained in the form of blooms, which were advantageously sold in the United States.

Unfortunately the American manufacturers, in 1875, ranked this product in the class of bar iron instead of pig iron, where it was before, thus raising the duties from $7 to $33.60 per ton (1½ cents per pound.) Probably other technical and financial reasons prevented the development of that industry, which was given up. Attempts were actually made to export that mineral in a rough state, but the American market with a duty of 75 cents per ton was not favourable.

In speaking of iron, we must mention that in 1867 a blast furnace was built at Hull (Ottawa), to use an important deposit of magnetic iron, but was in operation only for a few years. In 1872, near Ottawa, a bloomary furnace was in operation several years, using the ore at Haycock mine. In 1873, a company was organized, and built two blast furnaces at St. Urbain (Baie St. Paul), near a considerable deposit of titanic iron. Those furnaces, after having produced at a very high price, a few hundred tons of pig iron, were abandoned and the material sold.

In 1880, the iron works of Drummondville were established and they are still in operation.

In 1866 a by-law was passed fixing the price of the mining concession at $1 an acre and stating also the conditions of the sale. A similar regulation was repeated in 1874.

About that time public attention was brought on the phosphate mines of the Ottawa, and asbestos mines of the Eastern townships. In 1878 an act was passed to regulate the sale and the conditions of working the phosphate mines; this industry was at it beginning. Numerous properties were open, principally in the Township of Portland, Templeton, Buckingham and Hull. In 1877-78, the shipment made was about 3,700 tons of phosphates. In the last years, important discoveries in different places in Europe and the United States, caused a variation in the price, but nevertheless, we can say that the Canadian phosphates, considering its high average (80%) will have a regular market, and I consider that if the production is not more important, it depends more on the irregularity of the deposits than on any other cause. Up to date the total production has been nearly 250,000 tons. We must add that there exist large deposits not yet worked on account of the absence of easy means of transportation. Since a few years phosphates of inferior quality are ground at Buckingham and exported to the United States, while the first-class phosphate is shipped to England in a crude state. The most important deposits are in the County of Ottawa, but we find phosphates also in the Counties of Pontiac, Argenteuil and Berthier, and lately a very fine green apatite has been discovered in the Township of Radnor (Champlain), but so far as known in small quantity.

Nearly in the same time the asbestos industry grew at Thetford, Black Lake, and Danville, and the production which was of a few hundred tons in 1880, reached 8,000 tons in 1890. I will not take up your time with any reference to that industry, on which you are doubtless better posted. Asbestos has also been discovered in the eastern part of the Gaspé Peninsula and at Lake Temiscamingue; in this last part of the country in the same formation as that of the Eastern Townships.

In the Laurentian formation, principally in the Ottawa County, asbestos is found in numerous deposits, but the fibre is shorter although of good quality. I consider that to be profitably worked it should be treated by mechanical process to separate the fibre from the rock.

Mica is also found in numerous places in the Laurentian range, and is extensively worked in the Ottawa County. Until two or three years ago only the Villeneuve mine was operated for white mica, but now with the new use of mica for electrical purposes, many mines of dark and amber mica are in operation, and every day we hear of some new discoveries.

Plumbago, in a disseminated state, is found in many places in the same formation, and has been worked a little and manufactured, especially in Buckingham Township.

Precious stones, not much considered until now, exist also in the same formation.

To conclude with the historical part of mining in this province, I must say that in 1880 a mining law regulating the sale and conditions of working for all kinds of mines, was passed.

In 1890 another act, based on an entirely different principle, was substituted for the law of 1880. In 1892 a new law was passed, based on the principles of the Mining Act of 1880, with some new dispositions, and repealing useless clauses.

Actually the mines in the Province of Quebec are regulated by the "Quebec Mining Law," 55, 56 Vict., Chap. 20.

To recapitulate the present situation of the mining industry in the Province of Quebec, we see asbestos, copper, phosphates and mica in regular operation; gold, iron, graphite and ore a little worked; important borings are made in Gaspé for petroleum—it exists in the centre of the province—serious indication of natural gas; moreover we have a mine of antimony at South Ham; one of Galena at the Lake Temiscamingue; and one of silver ore in Marlow, (Beauce). I must say also that there exist very large areas covered by peat, which may become useful as fuel.

Amongst the building and ornamental stones I will mention the Deschambault and Montreal limestone, granites of Stanstead and of Lake St. John district, marble of the Ottawa and Pontiac Counties, slates exten-

* Paper read before the Asbestos Club, October, 1892.

sively worked at New Rockland and found in different places of the Eastern Township, etc.

If we examine the map of the Province we see all the north part of the St. Lawrence and Ottawa rivers forming the Laurentian range unexplored, except a small band. On the other side of the river, the Eastern Townships are well prospected. From Quebec going south and east, except alongside the shore, the territory is unexplored as well as Gaspesia. We see, therefore, that a large field is yet open for exploration.

MINING NOTES.

[From our Own Correspondents.]

Nova Scotia.

Caribou.

The Truro Gold Mining Co. has bought out the remainder of the lease held by the tributers, and is now operating the property on company account, under the direction of Mr. Geo. W. Stuart, one of the owners. The shaft has reached a depth of over seventy-five feet, and shows some very rich quartz. Four tons hoisted in the early part of the month were judged worth over $1,000. The machinery is now being overhauled and put in condition for steady work.

Central Rawdon.

Some work is being quietly done here by Mr. Dimock and associates, west of the old property. The results thus far have been very encouraging, the largest lode found being 15 inches in width and showing fairly in gold.

Fifteen Mile Stream.

It is announced that the Egerton Co. will permanently close work in this district this winter, unless pay ground is struck soon. The management contemplate hauling out the machinery in the snow and erecting it upon another property in a different district, which rumor says is Goldenville.

Montague.

On the 15th of the month, Mr. Woodhouse brought into Halifax a bar of 277 ounces, from the DeWolfe lode of the Nova Scotia Gold Mines, Ltd. The work of raising the landing, and erecting the gallow frame is nearly completed, and the cutting down of the footwall to make No. 5 shaft vertical, is going ahead with three gangs working 8 hour shifts. The small donkey hoist taken from the Waverley mine, will be used here for the main three compartment shaft. The total product of the mines since Aug. 1st, has been 748 ounces.

The boiler and engine bought from the old chlorination works at Waverley are to be set up on the Symons-Kaye areas, and will furnish the power for mining. This property, according to the Halifax *Herald*, has been transferred by Mr. Woodhouse to a syndicate for $12,000 stg. cash and stock.

Oldham.

The sworn returns in the Mines office show that the first crushing from the property latterly acquired by the million dollar syndicate from Attleboro and Providence, gave 14 ozs. 9 dwts., from 30 tons of quartz, an average of $9.40 per ton. In the September issue the yield per ton was put at one ounce, or $19.50. We make this statement in correction.

Stormont.

The Richardson gold mine will be equipped with a 15 stamp mill by Matheson & Co., of New Glasgow. W. W. Howell & Co., of Halifax, are furnishing a hoisting engine with two spools. Matheson & Co. will furnish the boilers for the plant.

Uniacke.

In the Mount, Messrs. Madill and Archibald are working on the western end with a small crew of men, but with indications of final success. The mines of the old British and Colonial Land Co. have been pumped out and have been examined by an expert on behalf of the owners. This is the property managed in 1887 and 1888 by Capt. John Nicholls. Of the expensive mill built by Fraser and Chalmers, nothing remains but the shell of the building. The underground workings are reported to show abundance of quartz, but the levels and cross-cuts will need overhauling.

Waverley.

The 10 stamp mill of the West Waverley Co., Ltd., crushed 540 tons of quartz in 20 days run in September. This is believed to be the best record yet made in Nova Scotia on hard quartz. The ore was low grade.

The cross-cut tunnel into Laidlaw's Hill, East Waverley, is getting very wet, and the men expect to cut the Barrel lode daily.

Quebec.

Templeton District.

Judge Dugas has been working a gang of about twenty men close to Perkin's Mills. About twenty-five tons selected mica is being won monthly. He has had an offer from a Montreal capitalist to equip the property with first class plant, employing forty hands, and $10,000 for a half interest. The property looks well, although but thirty feet have been sunk.

On the Carey lot, McGregor Lake, Mr. L. K. Lee has taken out quite a quantity of amber mica, which at thirty-five feet has been cut out by phosphate. The phosphate is high grade, similar to that of the Blackburn mine; the show at bottom of pit is about 18 by 15 feet. Sixty tons have been taken out so far.

On the Charette, lot 4 in the 9th Range, the Templeton and North Ottawa Mining Co. has had five or six men working a show. There is an immense bed of crystals, many of which, however, are badly broken up. About five tons selected mica has been taken out.

About 100 men, including prospectors, are working mica in the district this year.

The Blackburn phosphate property is reported to have changed ownership. Only 15 or 16 men are now employed. The property never looked better. Last month about 250 tons lumps and about 150 tons sands and seconds were extracted.

The Electric Mining Company shipped last week 425 tons phosphate by barge to Montreal. The ore was shipped for City of Lincoln steamship to Liverpool. The analyses made by Prof. Donald gives 82.47 for the high grade and 74.48 for seconds and sand. Mining will be resumed at the Bull Dog next month.

Mr. C. Circkel leaves early in December for a six months' visit to Germany. He will likely return in the spring for the Templeton Asbestos Company.

The Wallingford and Hillman property, which has been closed down owing to Mr. Thomson's injunction, has a very good showing, both in mica and phosphates. About 25 tons of former and 75 tons phosphate has been taken out since June 1st.

In the Gore of Templeton about 30 men are working surface shows on four or five different properties.

Hull Township.

Messrs. Chas. Brennan and Wm. Powell are working 10 or 12 men on the Toby, lot 7 on 11th Range. The surface crystals are very large, and numerously scattered at the base of the hill. The title is assailed by Mr. T. J. Watters, who lately acquired an old mortgage. Some years ago this lot was worked by the late Mr. French for barytes.

McRae and Allan are working nine men on the Kearney, lot 6 in the 11th Range. About 15 tons mica have been taken out during the last 10 or 12 weeks. Deep tests on this lot are now being made with the Diamond drill.

The Nellie and Blanche mine, recently purchased from the Haycocks by Watters & Co., has been fully equipped with two drills, hoists, etc., and is turning out about 40 tons high grade mica monthly. A large deposit in a rear part of the property has been uncovered a few days ago. The crystals cut 14 x 10 clean.

The Horse Shoe Mine recently acquired by Messrs. Watters & Co., employs about 45 men. The output is very satisfactory, about 20 to 30 tons monthly.

Webster & Co. are working 30 to 40 men on their Cantley properties. The mica is all shipped to New York and Boston.

The McCuaig syndicate at Wilson's Corners are opening up some good shows on the McLellan lot. Mica mixed with high grade phosphate in paying quantities is now being taken out.

Fully 500 men are now engaged in mica mining in the Townships of Hull and Wakefield, and these districts are overrun with prospectors. Every settler carries samples to church, and the bars of the leading hotels on the road are profusely decorated with specimens of all grades and shades.

Lievres River.

In the Lievres district probably 75 to 100 men are engaged in mining and prospecting for mica. The biggest shows found this season are on the Little Rapids property.

Mr. Wm. McIntosh is working on the Union under royalty, and is taking very large crystals of high grade amber mica.

The continued depression in the European market is evidenced by the very limited extent of the phosphate mining operations in this district. The High Rock Mine with a reduced force of about sixty men has raised about 3,000 tons of all grades to date, about 2,000 tons of which has been exported. The Squaw Hill and Aetna mines of the British-American Phosphate Company are the only other mines being worked to any respectable extent. Recent mining has revealed some fine shows of the mineral, and the management are reported to be encouraged by the prospects of productive mining. Mr. J. B. Smith is contemplating the introduction of a plant of greater capacity.

The Weart's Plumbago mine is worked with a moderate force, and the output is reported satisfactory.

Beauce District.

Mr. E. B. Haycock, Ottawa, is making a practical effort to demonstrate the value of the alluvial gold areas known to exist over a large area on the Chaudiere and elsewhere in this region. Last summer he acquired what is known as the Star gold mines, containing an area extending over 1,500 acres on both sides of the River du Loup. Mining is being carried on by a force of some sixteen men at a point about a mile distant by road from the settlement of Jersey Mills. Mr. Haycock states that from the quantity of gold already obtained and the indications of its existence on the property, he is satisfied that his venture will be a profitable one. An engine and boiler has been put in by Messrs. Carrieré Lane, & Co., of Levis, and a small portable three stamp mill is on the way from the establishment of Fraser and Chalmers, Chicago, for preliminary working. Over two miles of steel piping has been laid, and a drainage dam 250 feet long, 8 feet high, with a face of 24 feet, has been built. Buildings to accommodate a good working force have been erected. Either a Huntingdon mill or an ordinary ten stamp mill will be put in in the Spring. On the same property Mr. Haycock has found some promising veins of free-milling ore.

Mr. W. P. Lockwood has about fifty men operating on his Gilbert River gold mines. After many reverses and discouragements, Mr. Lockwood has struck good pay ground, and profitable working is assured.

Mr. A. McArthur, of Toronto, who has been working for some time with good results on the Gilbert River, is reported to have sold out to a Boston syndicate. The new company is arranging for suitable mining and milling plant.

Good pay ground has also been found by the force of men working under Mr. Capel on the Mill Stream.

Ontario.

Marmora District.

The Hastings Mining and Reduction Co. is pushing forward the construction of its roasting plant. The works will be equipped with Blake crusher, Griffin mill, Walker-Carter roaster, arsenic chambers, drying pans, etc. Mr. Thos. Walker, of Philadelphia, is superintending operations. The plant which will cost in the neighborhood of $20,000, will be completed by the end of December. The company is also mining on the Gatling and other properties, a few miles from the town of Marmora, under the direction of Mr. W. H. Wylie, formerly of Carleton Place.

Mr. Middleton-Crawford, Toronto, inventor of the Crawford Milling Process, has purchased, and is now operating the Belmont gold property (better known perhaps as the Lingham mine). Two Crawford mills are to be put in. An engine and boiler, the first of the plant to be used, was shipped on the 8th instant, from the works of H. W. Petrie, Toronto.

Mr. T. P. Pierce, who has been prospecting on lot 18, in the 1st Concession of Belmont, has brought in some fine specimens of free gold. He reports very favorably of the indications for profitable working given by the strippings done on the property.

The Crescent Gold Mining Co. of Marmora is working a force of men on their properties, under the direction of Mr. McDougall.

Sudbury District.

The Drury Nickel Company, under the management of Mr. T. Travers, is working briskly with a strong force. The mines have been equipped with an efficient smelter and machinery equipment. Shipments of matte are being made.

From the Sudbury *Journal* we learn that over twenty men are now employed at the Worthington mine putting the two old shafts in shape for working the mine on a large scale. A sleeping house, 22 x 42, for the workmen, is being built near the boarding house. The railway switch has been moved to the north side of the track for better convenience in shipping ore from the mine. Everything is being done in a business-like way. "'Tis the march of the Cameron men."

It is reported that the Vermilion mine will be re-opened at an early date.

The supply of ore being sufficient for all requirements, the working force at Copper Cliff has been temporarily suspended.

From the Sudbury Journal.

After the quietest season in the history of mining in the district, we are happy to be able to report that things are beginning to look up again on all parts of the Range, and that the prospects of mining here are much brighte this fall than they have been for the past two years. The closing down of the Blezard and Worthington mines last fall, combined with various other circumstances, had a very depressing effect for a time, but both these mines have been started again under new and vigorous management, and evidently with the intention of carrying on more extensive operations in the future.

All the other old mines are being worked as usual, except that a smaller number of men are being employed under-ground in the Copper Cliff mine. But this reduction of the staff is said to be only temporary, and due to the fact that enough ore has been been got out already this year to keep the smelter going all winter.

Down the Range, the Travers mine has been well explored, showing a large body of high grade ore, and the smelter is now in full blast. A tramway has been built from the mine to Worthington siding, a distance of four miles.

The Finlander's claim, which has been purchased by Philadelphia capitalists, is going to be opened up this winter, as well as two and probably three other properties in Denison and Graham.

On the property owned by Judge Toms and Mr. Waddell, near the Blezard, Messrs. Clemow & Callahan, have done a lot of development work, with good prospects, and this firm have also been opening up and developing the Bonanza mine on Lake Wahnapitae, which we are informed looks exceedingly well.

So that altogether a good deal more development work is going to be done in the district this coming winter than in any previous season, with almost the the certainty of new and increasing activity and interest in mining here next spring.

This marked improvement in the outlook of the district is owing to several causes. The demand for nickel is growing slowly but surely every year, and with all the successful experiments that have been made there can be no serious doubt any longer that nickel-steel is destined to be the leading metal of the future for many purposes. New and cheaper methods of treating nickel ores and making nickel alloys are being studied out, and especially in the United States. Last but not least, it is universally conceded that the main supply of nickel for the whole world will have to be obtained from the mines of this district. Capitalists are beginning to realize these important facts, and to foresee that a good nickel property is the best mining investment that any one can make now.

CANADIAN COMPANIES.

Truro Gold Mining Co. (Ltd.)—Gives notice of application for incorporation under the Companies Act of Nova Scotia. Authorized capital, $100,000, in 1,000 shares of $100 each. The directors are: Thos. G. McMullen, lumber merchant, Truro; Gardner Clish, Truro; Joseph J. Snook, Truro; George W. Stuart, Truro; John H. McKay, Truro; Wm. Fraser, Truro; Lucues B. Crowe, Truro; and J. B. Neily, of Halifax. Formed to acquire and work gold areas in the district of Caribou or elsewhere in Nova Scotia.

River Hebert Mining Company (Ltd.)—Gives notice of application for charter of incorporation under Nova Scotia laws. Capital $9,900, in 99 shares of $100 each. Head office: Amherst, N.S. Directors: Gilbert Seaman, Minudie; Amos Seaman and Rufus S. Hibbard, Lower Cove, N.S.; A. R. Dickey and J. M. Townshend, of Amherst. Formed to mine, quarry, win, etc., coal, iron, stone and other minerals.

Gold Queen Mining Company.—Registered at Victoria, B.C., 30th September, 1892. Authorised capital, $400,000, in 4,000 shares of $100 each. Formed to locate mines and develop the same, and to buy, sell, lease and operate mines, mining stock and properties, etc. Head office, Yale, B.C.

The Coal Hill Kamloops Mineral and Mining Company (Ltd.)—Gives notice for charter of incorporation under British Columbia Act. Capital, $150,000, in 1,500 shares of $100 each, with power to increase the same to $500,000. Trustees: Henry E. Edwards, John A. Webster, and Joseph W. Vaughan, all of Vancouver, B.C. Head office: Vancouver, B.C. Formed to purchase and acquire all rights and privileges in certain coal lands and mines owned and carried on by H. V. Edwards, J. A. Webster and J. W. Vaughan, at or near the town of Kamloops, in the Province of British Columbia, and carry on the same, etc.

Ontario Silver and Antimony Company (Ltd.)—Gives notice of application for charter of incorporation. Authorized capital, $150,000, in 150,000 shares of $1. Head office: Toronto. Formed to carry on mining in Township of Barrie, in the County of Frontenac, and elsewhere in the Province of Ontario. Directors: Isaac M. Scott, contractor, Townsip of York; James C. Cockburn, Toronto; and John Critchley, contractor, Toronto Junction, Ont.

The Thomas Nightingale Pressed Brick Company of Toronto—Gives notice of application for charter of incorporation. Authorized capital, $50,000, in 1,000 shares of $50 each. Head office: Toronto, Ont. Directors: W. Van Alstine Cook, druggist, Toronto; Charles Henderson, barrister, Toronto; and Mrs. Margaret Nightingale, Toronto. The operations of the company are to be carried on in the Counties of York and Peel, and the city of Toronto and elsewhere in the Province of Ontario.

Indian Lake Mining Company—Authorised capital, $50,000, in 2,500 shares of $20 each. Head office: Toronto. Directors: Wm. Harty, Kingston, Ont.; T. W. H. Leavitt, Toronto; and J. C. Judd, barrister, Toronto. The operations of the company to be in the Counties of Frontenac and Leeds in the Province of Ontario.

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The Low Phosphorus Ores Properties Company of Ontario (Ltd.)—Authorized capital, $350,000, in 3,500 shares of $100. Head office: Toronto. Directors: Frederick, T. Jones, New York; Dr. Colin McDougall, New York; C. W. Gleason, Passaic, N.J.; Robert Fyfe, Brooklyn, N.Y.; and T. D. Ledyard, Toronto. The operations of the company are to be carried on in the Counties of Haliburton and Peterborough, and elsewhere in the Province of Ontario.

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Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

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SOME REMARKABLE RESULTS IN GOLD EXTRACTING.

New York *Sun*, Sept. 12.—"The Crawford Gold extractor, which was recently put into the Richmond Hill at Hillsborough, New Mexico, is giving satisfaction. It has been tested on runs of ores from different mines in the district with uniform good results."

Salt Lake *Times*, Aug. 28.—"Mr. Woodman came in from Deep Creek yesterday, where he has been for a month or six weeks, and he pronounces the Crawford mill a perfect success, saying that since the mill started it has saved 92 per cent. of the assay value of the Gold-Hill ores, some of which are very rebellious."

John C. Smith, Supt. of the Ogema Mining and Smelting Co., says: "It gives me great pleasure to add my testimony in favor of the Crawford mill in every way, as to its 'gold saving qualities,' 'practically no loss of mercury,' 'small volume of water required per ton of ore,' great ease of manipulation,' also as to its portability to mines remote from railroads, and 'ease of setting up ready for operation.'"

L. J. Boyd, M.E., Supt. Montagu Mines, after personally supervising a test on arsenical ore says: "The results were simply wonderful. I am personally perfectly satisfied with this system of ore treatment, and should advise its adoption, as the experiments were carried on by my personal superintendence. Similar ore was treated by the Montagu stamp mill showing a difference of 100 per cent. in favor of the Crawford mill."

Fredericksburg, Va., *Free Lance*, Sept. 6.—"L. G. Johnston, of this city, in an interview, said he sent to the M.G.E. Co., N.Y., one ton of very low grade sulphuret ore from the mines of the Powhattan L. &. Mining Co., Culpepper Co. He went to New York and personally witnessed the working of the ore. The results of ten different samples of ore, averaging in assay value from $2.13 to $7.35 per ton, showed a saving of 88 per cent. of the value by actual mill run, this without the use of chemicals or fire. These results were so satisfactory that a large sized mill will be placed on the property at once."

W. D. Sutherland, Secretary of the Salisbury Gold Mining Co., of Nova Scotia, after having over 4 tons of ore treated by the Crawford mill, says: "Sample of the tailings taken during the run showed by assay an equivalent to 0.033 oz. to the ton. This evidence of the capability of the Crawford mill to extract all but a trace of the gold which the ore may contain must be considered of importance by all who are interested in the question of improved methods of milling gold from the ore. The test alluded to was made under the supervision of our company through trustworthy agents."

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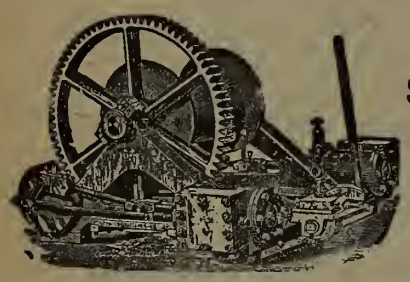

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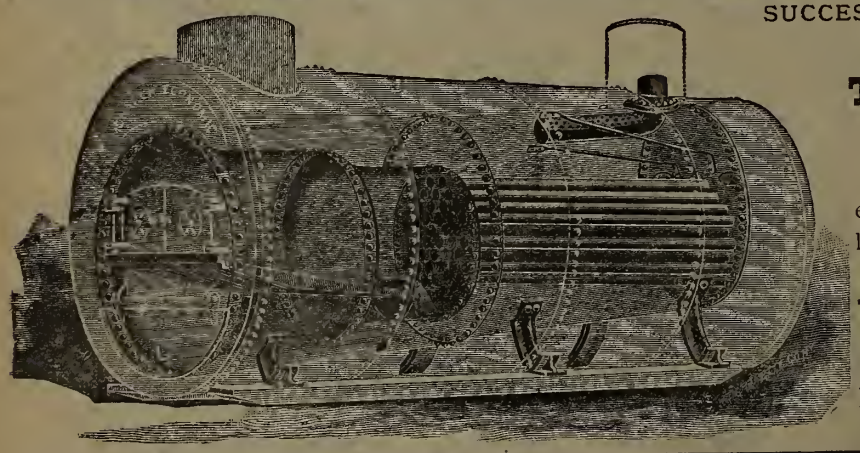

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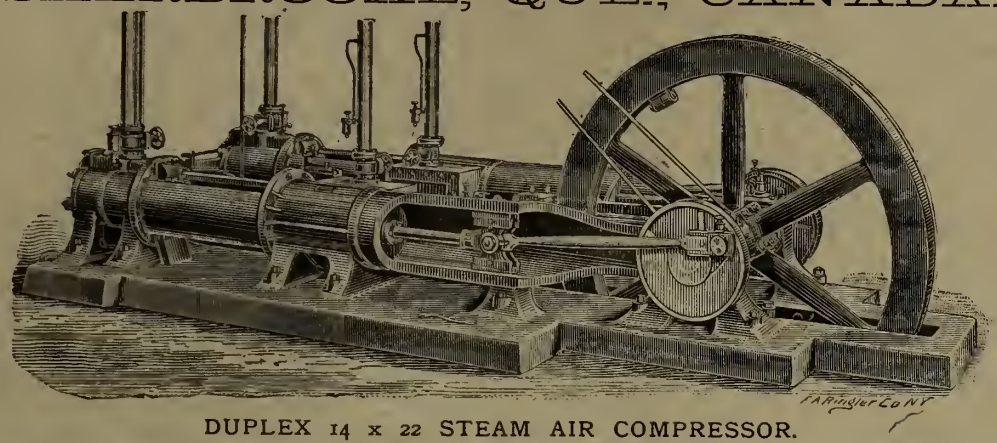

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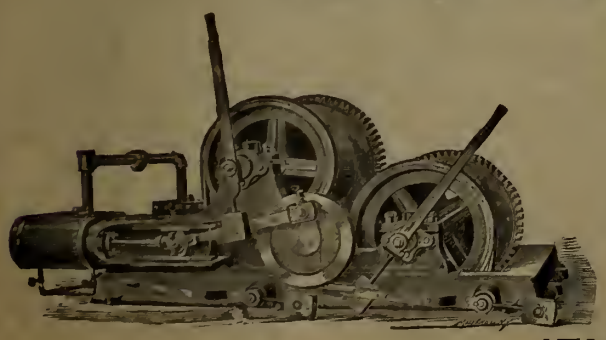

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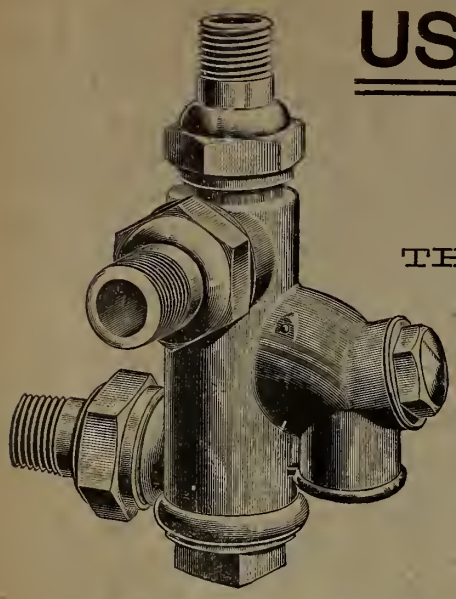

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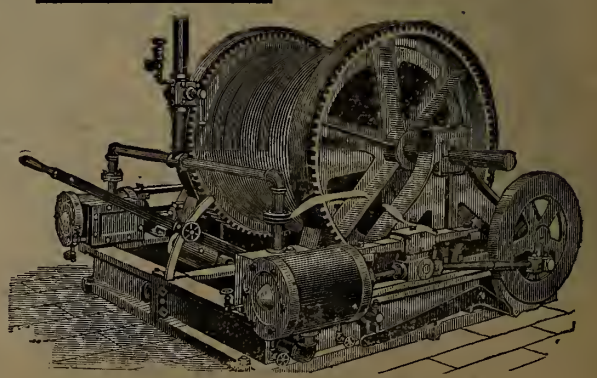

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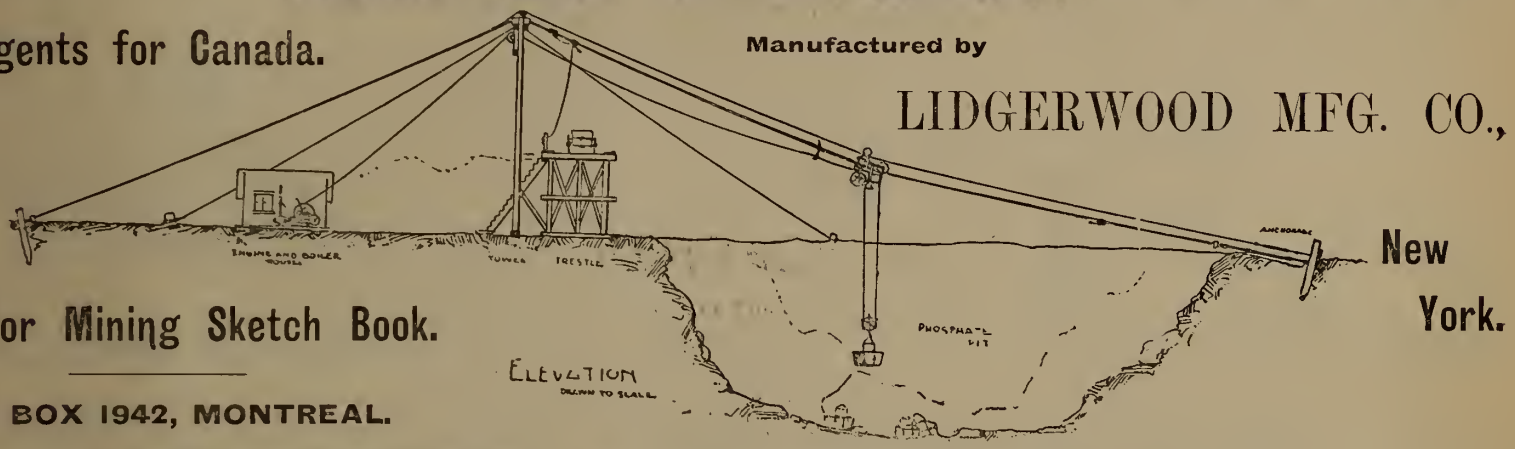

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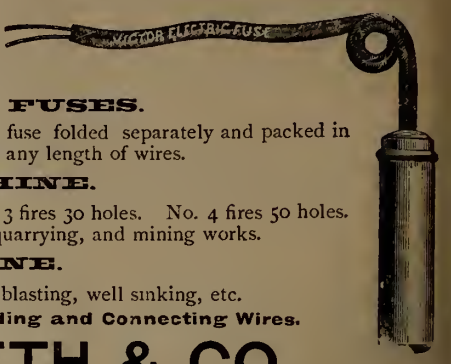

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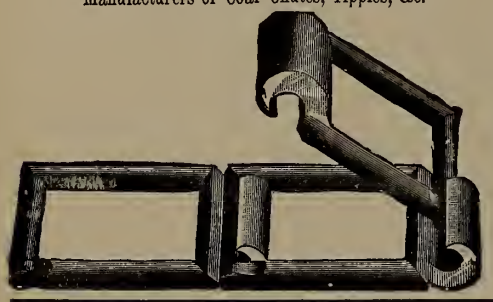

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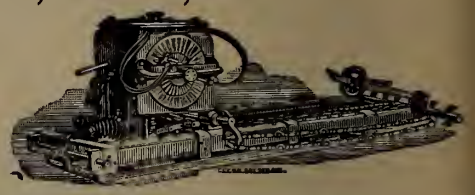

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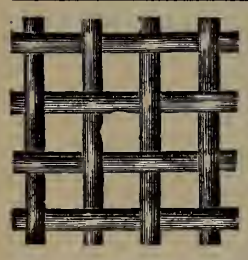

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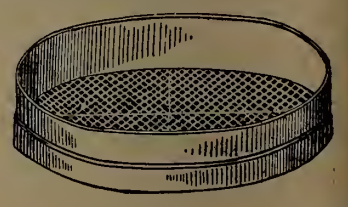

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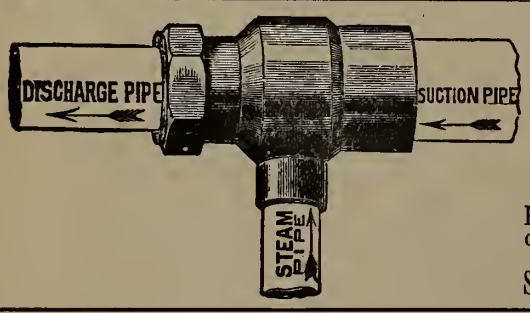

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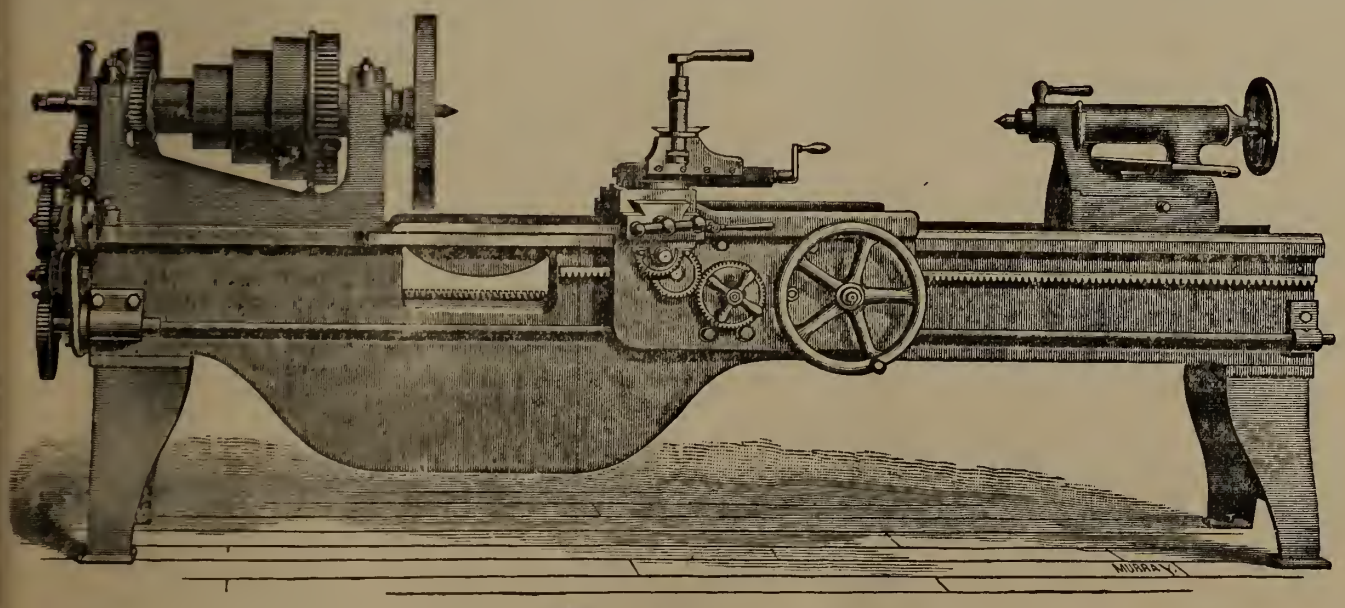

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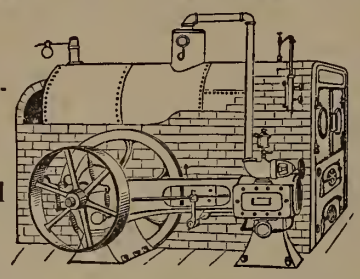

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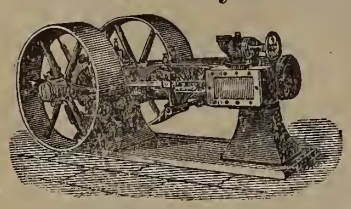

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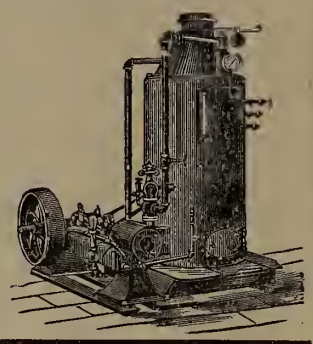

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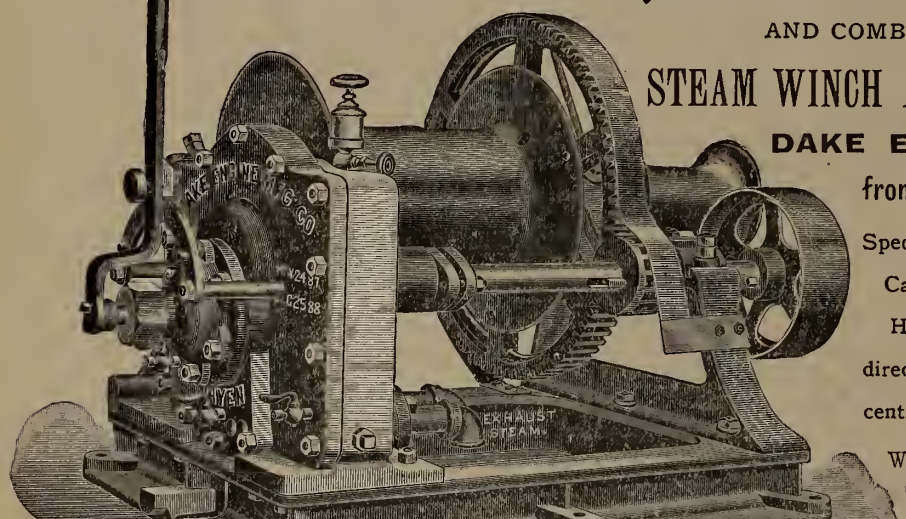

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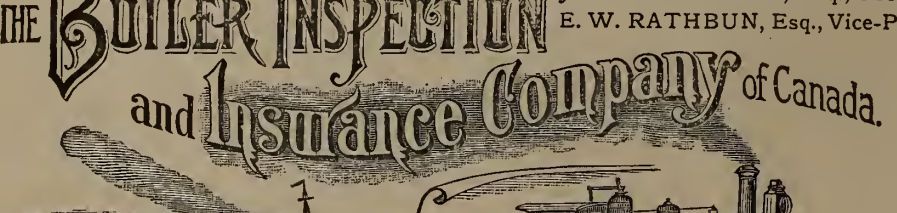

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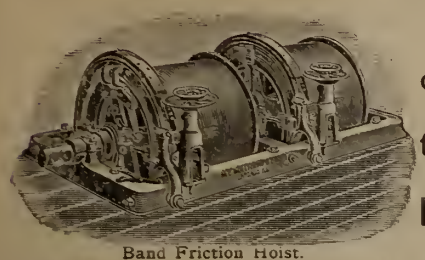

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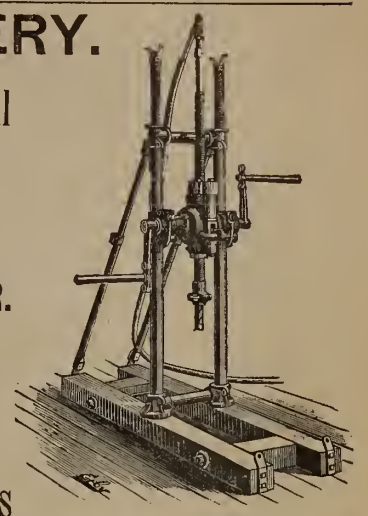

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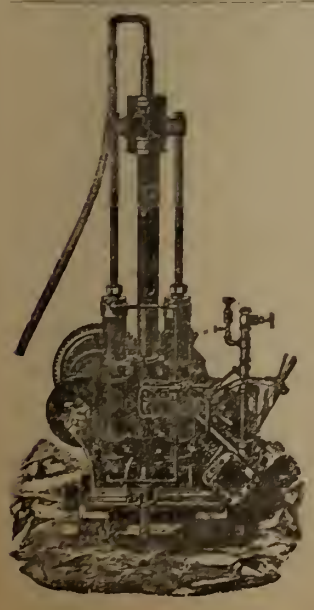

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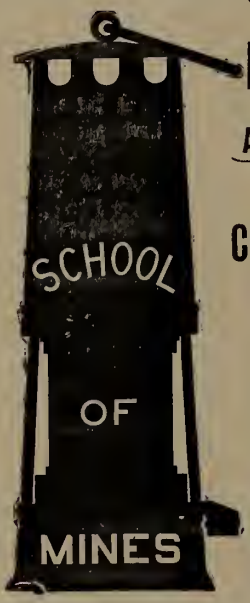

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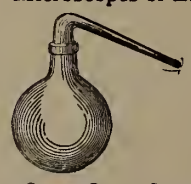

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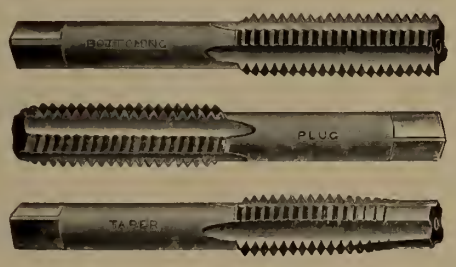

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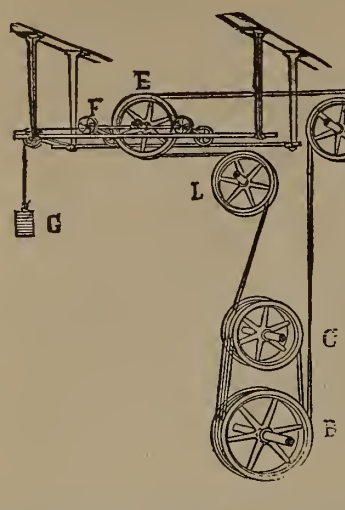

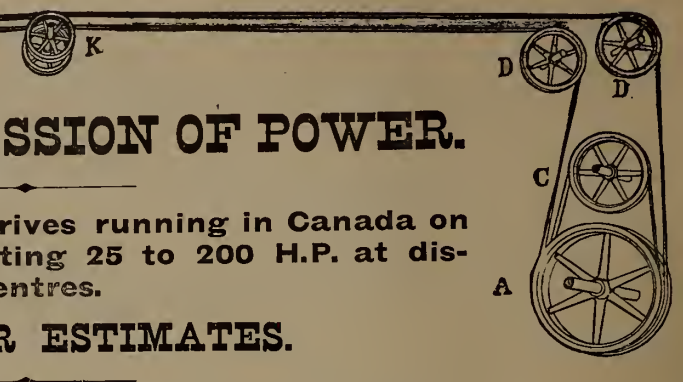

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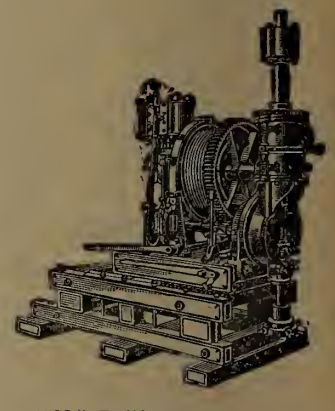

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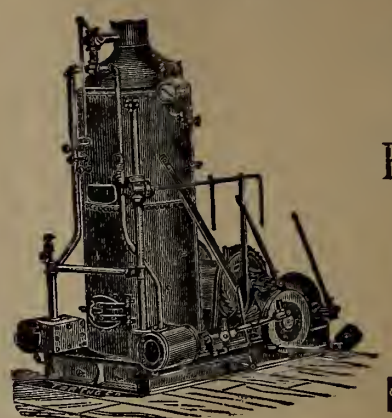

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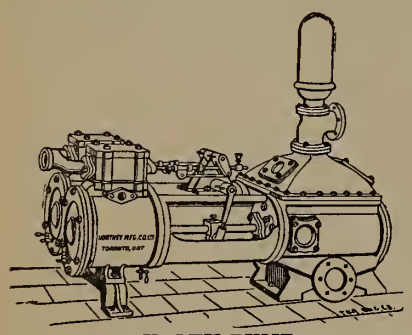

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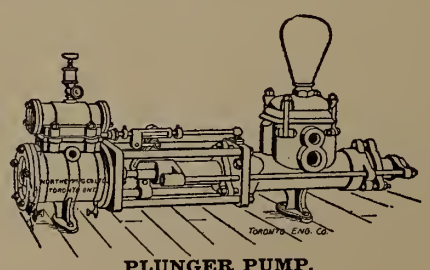

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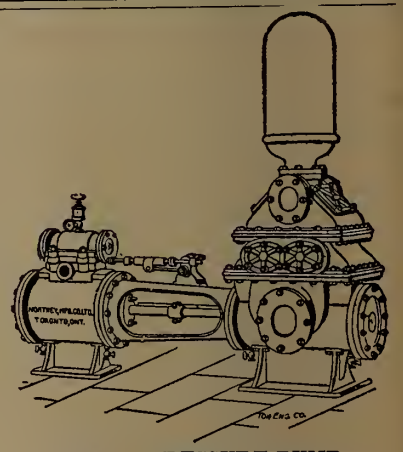

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CANADIAN MINING & MECHANICAL REVIEW

CONDUCTED BY - - - - - - B. T. A. BELL.

THE OFFICIAL ORGAN

—OF—

THE GOLD MINER'S ASSOCIATION OF NOVA SCOTIA,

THE UNITED MINING SOCIETY OF NOVA SCOTIA,

THE ASBESTOS CLUB, QUEBEC.

THE GENERAL MINING ASSOCIATION OF QUEBEC.

THE following Resolutions of Council indicate beyond a peradventure the status of THE REVIEW as the exponent of the Canadian Mineral Industries:—

The Gold Miners' Association of Nova Scotia.

"At the annual meeting of the Gold Miners' Association of Nova Scotia, held at Halifax on 6th March, 1889, THE CANADIAN MINING REVIEW was adopted the official organ of this Association.

(Signed), B. C. WILSON, *President.*
G. J. PARTINGTON, *Secretary.*

The Mining Society of Nova Scotia.

"Moved by Mr. R. G. Leckie, seconded by Mr. C. A. Dimock, That the thanks of the Society be tendered to Mr. B. T. A. Bell for his kind offer placing the columns of THE REVIEW at the disposal of the Society; and that THE CANADIAN MINING REVIEW is hereby appointed the official organ of the Society."

(Signed), H. S. POOLE, *President,*
H. M. WYLDE, *Secretary.*

The Asbestos Club, (Quebec.)

"Resolved: That THE CANADIAN MINING REVIEW is, by authority of the Members and Council, hereby appointed the official organ of the Asbestos Club."

(Signed), D. A. BROWN, *President.*
A. M. EVANS, *Secretary.*

The General Mining Association of the Province of Quebec.

At a meeting of Council held at Montreal on Friday, 6th May, 1891, it was moved by Captain Adams, seconded by Mr. R. T. Hopper, and resolved: That THE CANADIAN MINING REVIEW be the official organ of the Association.

(Signed), GEORGE IRVINE, *President.*
B. T. A. BELL, *Secretary.*"

OFFICES:

Victoria Chambers, 140 Wellington Street,
OTTAWA.

Vol. XI. NOVEMBER, 1892. No. 11.

Nova Scotia Coal Royalty—Anomalies in the Attorney-General's Argument.

Commenting on the memorandum of the Attorney-General of Nova Scotia addressed to the Minister of Justice, Ottawa (published elsewhere in this issue), the lessees of coal areas in Nova Scotia pass over his first paragraph and merely say of the second that if his argument be good, necessity knows no law, and impecuniosity justifies theft and highway robbery. To make a bargain and break it is no breach of faith or honest dealing when the power exercised is that of the Legislature; for does he not say that "any attempt to abridge this right might lead to Provincial bankruptcy."

Mining royalties, too, are clasified as a species of direct taxation, and to tax direct "is an undoubted right which would involve the gravest consequences if interfered with in the slightest degree." The right to tax is not in this case questioned, but that the mining royalties are taxes is denied: the royalty represents the title of ownership retained by the Province when leases are issued, and is comparable only to rental charged by a landlord. To call it a tax is grossly misleading, and before committees of of lessees Premier Felding repudiated the idea of making the imposition as a tax.

The lessees have endeavored to blow aside the cloud of verbal subtlety cast around this question by the learned Attorney-General, and have it stand forth naked and stripped of the cloak of power of the Legislature which has been thrown over the rights of the Legislature as the *landlord*—rights that are not disputed, rights that the petitioners to His Excellency the Governor-General have not complained of, and rights which they have asked be referred to a reputable legal tribunal to decide whether as those of a mere landlord—other than the Legislature—they would justify that landlord to increase the rate of royalty during the currency of a lease when a specified rate for a specified time was distinctly stated in the lease.

In the third paragraph the explanation in answer to the charge that the Act complained of is retroactive may be true enough, but it leaves the Act as it was—retroactive—and to that extent discreditable and objectionable.

The fourth paragraph is recognized as a masterly expression of human weakness and constitutional rights that cannot be gainsaid.

Nevertheless in the fifth they respectfully dissent from the statement that a "distinct offer to introduce an Act to authorize the Government to enter into a contract with the leaseholders to the effect that the royalty should not be increased beyond a certain maximum figure which should be agreed upon." Such a remark was casually made, and so also "we will forfeit your leases." But to say that "this the coal owners after some consideration declined" is a flight of imagination. What was said was offhand and to the effect that the representatives of the lessees present had no authority, even if they would, to compromise rights which affected even a shadow of title. Besides, the Government, if they wanted to pass such An act could of course do so without the consent of the lessees.

Turning now to the opinion of Mr. Ross given in January, 1892, no comment is required on the historical part, but exception is taken to the opinion that the Government were in the same position in respect to the coal mines as they were prior to the lease of 1826. The exception taken is that in July, 1886, lessees *were entitled to a renewal of existing leases "on the same terms, conditions and covenants as are contained herein."*

Secondly, he states that "the Act of 1885 also provided that all leases renewed in 1886 should contain a provision that the royalty might be increased, diminished or otherwise changed by the Legislature"—a statement entirely at variance with the published Acts; for section 4 of the amended Act Chapter 7 reads "all leases *issued* after the passing of this Act," clearly having reference to *new* leases, not to *renewed* leases, which were considered by section 105, subsection (*e*) which reads "In the case of leases that *are elegible for renewal* in which the conditions of renewal embodied therein are different from those prescribed by this Chapter, and the lessees thereof are unwilling to have such conditions altered, the Commissioner shall have power to renew said leases on the terms contained therein and as prescribed by Chapter 9, R.S., fourth series, and no other."

Seeing then that Mr. Ross' grounds are based on a misquotation of the Acts, his conclusions therefore may be ignored.

The report of the Hon. Mr. Longley, April 18th, 1892, now calls for notice, and agreement is readily granted with his opening paragraph—"That the rights of lessees of coal mines must be determined by the Statutes of the Province of Nova Scotia and the leases made under them." Mark the words—"rights * determined by * * the leases!" With them he strikes the key note of the lessees charge against the Government of Nova Scotia, that faith has been broken with men of means both native and foreign, who, induced by the reiterated assurances made on the floors of parliament, sunk their capital in Nova Scotia coal mines. And yet, "I am not aware," he adds, "of any Statute passed between 1858 and 1886 that gave to any lessee of a coal mine a right to a renewal that would not be displaced by Chapter 7, R. S., 5th series." Whew! What? Are the words relating to renewals incorporated in the body of leases issued between 1865 and 1885 of no meaning? Do they not carry "rights" to lessees, confirmed, it may be said, by the section 105 (*e*) of 1885 quoted above? And where does Chapter 7 of the 5th series attempt to override the terms of any current lease? It does nothing of the kind.

Again: he says "the Legislature bestowed a privilege that these lessees had no right to demand" when renewals were authorized. Does he knowingly ignore the debates in 1866 when both parties in politics were as one in the desire to encourage the development of mining by lengthening the period covered by the lease, and when, in consequence of the granting of this "right," large sums of money were sunk in opening and developing coal mines which it was distinctly stated would not be spent unless this right was granted, and would not have been so spent had it been dreamt that a subsequent Legislature would have jeopardized their prospects of recouping to themselves the heavy outlay they had made trusting in the good faith of Nova Scotia.

And here again he formulates "the statute must be read from the standpoint of the owner of the mines and not from that of the lessees." As a lawyer he doubtless is better able to judge of the intention of an indenture than a layman would be, and yet many of the latter suppose the instrument to be for the protection of both parties and certainly of the one who has ventured his capital on the good faith of the owner. When the owner is, as in the present case, the Legislature with its well known "power" to consfiscate, appropriate and forfeit individual belongings, it raises a smile when one is told a statute is to protect the owner from—from whom? From the lessees who are at the mercy of the Legislature, their money being sunk in the Province.

In this issue no one questions the right of the Legislature (as implied) to impose by statute

any stipulation they may care to devise and insert in any mining lease to be *issued subsequent* to the passage of the statute ; but what is objected to is the passage of legislation made to override the terms of leases issued prior to the adverse statute, as in this case.

The Cape Breton Coal Industry in 1892.

Although the Cape Breton collieries are by no means idle yet, work, nevertheless, is getting slack, the transient class of coal cutters and laborers who flock to the mines in the spring in search of work, have returned to their farms, or sought work in other districts outside of Cape Breton for the winter, and signs are apparent on all sides of the approaching end of the season of 1892. It will be necessary to wait another month before giving a complete review of the year or ranking the various collieries in order according to their shipments, but with the closing of the St. Lawrence trade, the back of the season may be said to be broken, and it is possible to form a fair idea at this juncture, of the success of the year from a stockholders' point of view. Following upon the highly encouraging result of 1891, the year now closing has been no doubt a disappointment, but it turned out better than was at one time expected and most of, if not all the collieries, have been probably worked at a reasonable, though perhaps, not a handsome profit.

The season opened out by no means auspiciously. The winter had been open and mild and unfavorable to a large consumption of fuel. Many people would probably be surprised to know what a tremendous difference an open winter makes in the consumption of coal, more particularly on railways. As a consequence of this mildness, large stocks remained on consumers' and dealers' hands at the opening of navigation, and to this cause, perhaps, more than to any other, may be ascribed the serious falling off in the shipments this year, as compared with 1891. Then again, the boom in ocean freights which had set in the fall before, had not altogether died out at the time when engagements had to be entered into with steamship owners for the coming season and rates ruled sixpence to a shilling (and in a few cases more) per gross register ton per month higher than the previous year. The companies that held off from chartering the longest, of course did the best, and those who began under easy sail and relied upon obtaining transient tonnage at low rates, did best of all, as the bottom dropped completely out of freights by the time the shipping season was under weigh, and abnormally low rates ruled during the season. not only on coal carried up the St. Lawrence, but in the coasting trade as well. Indeed one of the most remarkable features of the year was the low rates at which until nearing the close, steamers were obtainable for single trip charters. Perhaps $1.05 per ton may be taken as an average, but 90 cents was accepted in one case, and this rate ranks as the lowest ever yet paid on coal from a Lower Province port to Montreal. The low rates paid in the coasting trade cannot be ascribed so much to a superfluity of vessels competing for this business as to the further extension of the barge system introduced the previous year by Messrs. S. Cunard & Co., of Halifax. This firm has now four barges (wrecked barques cut down and repaired), of capacities numbering from 600 to 1,200 tons, which are kept going between Cape Breton ports and Halifax by the steamer "Dorcol," which herself carries a small cargo. The Glace Bay Mining Co. has this season acquired three barges, built as such after the whaleback pattern, which are towed by an ordinary steam tug. The impression in regard to these seems to be that they are too small, carrying not much over 400 tons, and that the tug employed is not altogether adapted to the business, as she cannot carry sufficient coal herself to last her the round voyage, entailing the purchase of coal for her bunkers en route.

In addition to the fact of the majority of consumers starting the season with a considerable balance of coal on hand, Cape Breton had had to face the loss of a large percentage of the Canadian Pacific Railway's contract, due to the purchase by that railway of a very large quantity of coal from the Drummond Mine, Pictou, and from Spring Hill, which meant a corresponding diminution not only in the quantity taken from Cape Breton, but in the price obtained therefor. Although not so uniformly good as in 1891, prices were on the whole fairly maintained and now at the close of the season, it is satisfactory to note that in spite of the causes that militated against the trade, the result has exceeded the expectations formed at the start. The deliveries of Cape Breton coal in the St. Lawrence this year have been 488,000 tons, as against 518,000 tons in 1891, or a decrease of 30,000 tons. Pictou (in this case practically represented by the Drummond mine) has on the other hand increased her deliveries by 40,000 tons, making a net increase for this year over last of 10,000 tons from the lower province ports.

Just here it may not be out of place to notice an article reviewing the coal trade of Cape Breton which appeared in the Halifax *Chronicle* a few weeks ago, which found its way into many other papers. Although dated from Sydney, C.B., it bears strong internal evidence of a close corporeal identity existing between the writer and the editor of a certain paper published in Stellarton, and mainly devoted to the coal trade of Nova Scotia. The tendency of the canny writer to "drop" (like Mr. Silas Wegg) into Scotch quotations, the ingenuous puff of his own paper as the organ of infallibility on all questions relating to the coal trade, and the sly allusion to the increasing fondness of the mine managers for the idea of reciprocity in coal with the United States, all point the writer as the little man who guides the destinies of the P.W.A., legislates without much check or hindrance in the provincial parliament in return for a pledge of the labor vote, and whose self-constructed mission it is besides to preach to the owners and managers of mines on matters upon which they must necessarily be much better posted and much sounder judges of than he can be. The article coming from such a source is strangely full of inaccuracies and false prophecies and is chiefly remarkable for a peculiarly patronizing, but well deserved certificate bestowed upon the proprietor and output of the Gardener mines. The *Empire*, Halifax *Herald* and the REVIEW, are all held up for castigation by the writer for stating that at a certain period during the past season, Quebec imports of provincial coal showed an increase of 50,000 tons over a corresponding period in 1891, and the said papers are accused of "manufacturing figures out of whole cloth in the interests of ingenious and over-zealous protectionists." The writer, while making this accusation does not give figures in rebuttal, nor have we been at the pains to ascertain whether the figures given were absolutely correct, but we think it is more than probable that at one period during the season there was such an increase over a corresponding period of 1891 as to approximate 50,000 tons. The Cape Breton collieries were all equipped for big work this year, and the local demand being much lighter than usual, they were able to devote particular attention to their St. Lawrence trade, and as a consequence coal was rushed up in such quantities as to over-tax the ability of buyers to take delivery. Hence—"the very bad feature in connection with this year's trade"—alluded to by the writer in the *Chronicle*—that the coal was not taken promptly off shippers' hands and hence the possibility, we venture to suggest, that although the increase from the Lower Provinces at the close of the season is only 10,000 tons, at an earlier stage it may have been considerably large as compared with last year. The figures relating to this season's deliveries can, we think be relied on and go to show that the *Chronicle's* scribe was rather "off" in the prophesying line when he wrote in the following pessimistic strain : "I am now in a position to state em-"phatically that the hope of an increased output "of coal this year held out by the *Empire* and "*Herald* was cruel and delusive. The shipments "of coal to Quebec via the St. Lawrence, to date, "are far below the shipments of last year and the "worst feature of all is that the large decrease in "the shipments from Cape Breton will not be off-"set by an anticipated increase of shipments from "Pictou County." The *Empire* and *Herald* were talking of Montreal alone and never promised a larger general output and the results shows that while Cape Breton shipments via the St. Lawrence have fallen off 30,000 tons only, the decrease has been more than offset by an increase of shipments from Pictou. After making this bad shot he goes on to state that the mine managers are staggered by the falling off in the demand for their coal and are now standing in an attitude of uncertainty as regards the possible benefits of reciprocity. The owners and managers of our mines have, we fancy, weathered periods of depression of a far worse kind before and we do not think they are doing much flinching just now. Their uncertainty, if any exists, is pro-

bably as to whether the mines will continue to be run as at present or pass into the hands of the New England syndicate, which question not unnaturally is monopolising attention just now in the minds of those interested in coal mining here. The *Chronicle* writer is no doubt correct When he says that Cape Breton county has favored protection, not so much because it is a part of the creed of a political party as that there has been money in it. He has himself been suspected of favoring the political party in which he thought there was most money (for himself). The great majority of mine owners and managers in Cape Breton have felt that to give Americans free access to the St. Lawrence market, in exchange for a free entrance to our coal into American sea-ports, would be a revolutionary and hazardous proceeding. It is true that some few were disinclined to believe that it would mean "blue ruin," but on the principle that a "bird in the hand is worth two in the bush," they have united in favoring the existing order of things. A company largely composed of powerful American capitalists controlling the Cape Breton mines and numbering among them some large consumers of coal, would be in a far different position for facing the reciprocity problem to the present owners of the mines. They would be introducing their own coal into their own markets and with the large means which without doubt they would command, would be able to reduce ocean freightage to a minimum by recourse to the barge system which now prevails so widely in the transportation of coal from American ports.

To hark back to the Cape Breton coal trade for the present year, we shall not be able to give the quantities shipped by each colliery till next month. Suffice it now to say that the only collieries to show an increase will be the General Mining Association, with both their old Sydney and Victoria Collieries, and the Gardener Company. The "Old Sydney" will probably regain its position at the top of the list which it lost in so signal a manner last year; for the first time in its history the Gowrie should play second fiddle to this company. The increase in the shipments of the General Mining Association collieries is reported to be 27,000 tons, 20,000 tons from "Old Sydney" and 7,000 tons from "Victoria." This increase is largely due to heavier shipments up the St. Lawrence. The Gardener Company's shipments are to date, 11,000 tons in excess of the same period last year. This company only got under weigh last year and its success is creditable alike to the proprietors and the character of their coal. On the other hand, all the other collieries show a more or less serious falling off. The "Caledonia" shows the heaviest decrease, with over 30,000 tons, the Little Glace Bay, International, and Reserve, are 15,000 to 20,000 behind apiece, and the Gowrie 12,000 tons. The "Old Bridgeport," which has recently been acquired by the International Coal Co., stands in about the same position as last year. It would look, therefore, as if Cape Breton would show a falling off in her total shipments this year, as compared with last, of some 65,000 tons; 30,000 tons of this have been accounted for by the fall off in the St. Lawrence shipments. The more serious decline has been in the local demand *i.e.* from Nova Scotia, New Brunswick, and Newfoundland. It is difficult to account for this falling off, unless it be attributed mainly to the fact (already alluded to) of the mild winter and the large stocks remaining on hand last spring.

The bunkering business in Sydney commenced fairly, but has fallen off lately on account of the collapse of Montreal freights homewards. At the time of writing the weather in Cape Breton is reported to be very mild and it looks very much as though another of the new fashioned open winters was setting in. Weather prognostications, however, are always hazardous and when we next address our readers we may (and sincerely hope we will) be able to report a return to the old fashioned theories.

Before concluding we may state that our last issue, containing a severe criticism of the management ot a certain English coal company, has created a very profound sensation among the trade. Our expose of the manner in which the interests of the shareholders have been subordinated to personal greed, has been appreciated gratefully, not only bythe shareholders, but by many otherpeople. The grasping and overbearing character of the Baron Munchausen-like individual who has forsome years presided over the company's interests in Cape Breton, has not endeared him to the community in which he condescends to reside, and should his employers take it into their heads to dispense with his services, as we have since been informed they have done, he may retire to his "hotels, ranches and mines" in Montana, whence he came, "unwept, unhonored and unsung."

Once More the "Critic."

"Consistency, thou art a jewel," is a saying which our esteemed contemporary, the Halifax *Critic*, would do well to paste upon the desk used by its mining editor. Here is one of its latest contradictions: (The italics are ours.)

(Halifax Critic, June 6, 1890.)

"Mr. L. Wadsworth, the "manager of the Lake "Lode Company, has prov- "ed himself a valuable man "to the Province, as has "he has not only *success- "fully managed* his own "property," etc., etc.

(Halifax Critic, Oct. 28, 1892.

"It is reported that the "Lake Lode will soon start "again, under *competent "management*, which will "be a *surprise to the mine*, "as its previous run of "seven years was by a "manager who never had "his foot on a ladder under "ground," etc.

This fulsome praise showered upon certain individuals, and the certification of "prospects" as valuable mines, is a prominent characteristic of the mining column of that estimable and highly original (?) sheet. A news item in our present issue regarding the sale of the Parker-Douglas plant, recalls such paragraphs (barely two years old) as: "The Parker-Douglas property will "oon be on a dividend-paying basis."

The muteness of the mammoth mill at Gay's River brings to memory the *Critics* prediction: "That it will eventually equal, if not exceed, in "value the famous Alaska mine."

And the solemnity with which that journal announced (July 17, 1891): "Tin has now un- "doubtedly been discovered in Nova Scotia," and spoke of outcrops of quartz veins as "the mine," is yet fresh in our memory.

The printing of testimonials from a trade circular as news for a mining column, is one of the latest happy thoughts of this *omnium gatherum*, but we advise it on general principles to go slowly, to consult the fyles of the Barberton (South Africa) *Herald*, and confine itself to "official reports," lest nemesis comes rapidly and more contradictory paragraphs occur.

The "Review" Stands to its Guns.

Our comment, in last REVIEW, on the management of the Sydney and Louisburg Coal and Railway Company's affairs in Canada, created no little commotion in the Nova Scotia coal trade. In Cape Breton the truth of the charges, which, by the way, have long been common gossip, were fully admitted and the course taken by the REVIEW was commended on every hand. In the offices of the Company it fell like a bombshell. With blood in his eye, Manager Kennelly started immediately for the West with the avowed intention of extracting an apology from us and the other papers into whose columns extracts from our article had been published. In consort with Mr. Henshaw, the company's popular agent in Montreal, the management of the *Star* was interviewed and, solely on the strength of the representations of these officers, and without any enquiry, a complete back-down was made editorially the same night. So much for the pluck of Canada's only independentpaper (?) Now as the article was written with our eyes wide open to the possibilities of a libel suit, we were not a bit surprised to receive the following from the legal firm of Greenshields & Greenshields:—

MONTREAL, Nov. 9th, 1892.

B. T. A. Bell, Esq.,
Canadian Mining Review,
Ottawa, Ont.

DEAR SIR.—We are in receipt of instructions from Mr. D. J. Kennelly, Agent and General Manager of the Sydney & Louisburg Coal & Railway Company, to institute proceedings against your paper for the recovery of damages by reason of a libellous article which appeared in the issue of the MINING REVIEW for October last.

Unless we hear from you by Friday morning, we shall issue Writ. If proper retraction and apology is made to Mr. Kennelly and payment of such legal expenses as he has incurred up to the present time, which would not be large, he will not press the matter into Court, but otherwise he is determined to put the case through. Your immediate attention in the matter will oblige.

Yours truly,
GREENSHIELDS & GREENSHIELDS.

To which we immediately replied:—

OTTAWA, Nov. 12th, 1892.

Messrs. Greenshields & Greenshields,
Notre Dame Street, Montreal.

GENTLEMEN,—Owing to absence from town I have, until now, been unable to acknowledge and reply to your esteemed favor under date of 9th inst. There is nothing to retract or apologise for in the article published in the October issue of this paper, so that your client may issue Writ whenever he pleases. We are in possession of ample and sufficient evidence to bear out our charges in every particular.

Instructions have been given to Messrs. Gemmill & May, Barristers, here, to accept service.

I am, yours truly,
B. T. A. BELL.

Again we repeat and emphasize every charge made against the Canadian management of this

company. Our article is bounded on the most substantial evidence as Mr. Kennelly will very quickly find when he takes us into court. In the meantime we stand by our guns and retract nothing.

EN PASSANT.

Latest European advices indicate a slightly upward tendency in the price of Canadian phosphates.

Our last issue was completely sold out within a week after publication. Any of our readers having copies of this number which they do not particularly desire to keep will confer a great favor by returning them to this office.

We have to acknowledge our indebtedness to Dr. D. T. Day, for a copy of the Eleventh Census Report of the mineral industries of the United States—a magnificent work which everyone of our mineral operators should have.

On the 7th instant a deputation from the General Mining Association of Quebec waited upon the Hon. E. J. Flynn, Commissioner of Crown Lands, and made application for a grant towards the International Mining Convention to be held in February next. The Commissioner promised to recommend the request to the Government.

The production of asbestos in the United States has shown an annual decrease since 1882. The product for that year was 1,200 short tons; 1883, 1,000 tons; 1884, 1,000 tons; 1885, 300 tons; 1886, 200 tons; 1887, 150 tons; 1888, 100 tons; and in 1889, 30 tons, valued at $1,800. No wonder Jonathan is so eager to put his surplus dollars in our productive Canadian areas!

Capt. T. J. Watters, Ottawa, to whose foresight, energy and enterprise is in no small measure due the establishment of the Canadian mica industry on its present satisfactory basis is to be made the subject of an attack during the next session of Parliament. Capt. Watters, as everyone knows, is the promoter and leading spirit of the Lake Girard Mica Mining Syndicate, an enterprise highly creditible to the Ottawa district inasmuch as its operations in crude and dressed mica are probably the most extensive in the world to-day. But Capt. Watters is also an officer of H.M. Customs—a highly efficient and hardworking officer to boot, if we may believe the statement of his Minister, the Hon. J. A. Chapleau—and his connection with the Civil Service it would seem debars him from investing his money, or engaging directly or indirectly in any business beyond the confines of his office on the Hill. The *raison d'etre* of the whole matter seems to have culminated from a dispute as to the ownership of a mica property acquired by the syndicate, and to which the friends of an Honorable and influential member of H. M. Senate also claim a title. A lawsuit between the disputants is now before the courts.

It has long been a source of wonder that, considering the extent and excellence of our deposits and the facilities for profitable marketing, the production of graphite in Canada should have lagged so far in arrear. Since the operations of the Lochaber, Dominion of Canada and other plumbago companies, away back in the sixties, when a fair quantity of the mineral was raised and exported, nothing worthy of the name of mining has been attempted in Quebec. This year, however, a decided step forward has been taken. Mr. Jacob Weart, of the Graphite Lubricating Co., Jersey City, has opened a mine in the Township of Buckingham, and has made some important shipments, a force of about thirty men being employed. In the same district, Mr. W. H. Walker, of Ottawa, in conjunction with others, has overhauled the mill and works formerly operated by the Dominion of Canada Company, and it is announced that a strong syndicate, to be shortly incorporated under Dominion charter, will operate on a large scale during the coming year. This looks like business. Respecting the character of Canada's graphite as determined by Mr. G. C. Hoffman, F.G.S., in charge of the laboratory of the Geological Survey, he reports that in respect to incombustibility, the Canadian product may claim perfect equality with that of Ceylon, and that it is in no wise inferior to the latter as a material for the manufacture of crucibles. In 1889, the United States imported 177,381 cwt. of graphite of a value of $378,057.

Until a comparatively recent date the use of graphite has been applied to the manufacture of lead pencils, crucibles, and to various preparations for stone polishing. Of late, however, other qualities, have been observed, which have opened to the mineral entirely new and extensive fields of usefulness; prominent among which is its consumption as a lubricant. For the bearings of heavy machinery, it makes a superior lubricant to oil, is clean, leaves no dripping grease, and one proper application will last as long as the bearings themselves. When the discovery was first made that graphite could be so utilized, some difficulty was encountered in keeping the lubricant in place. As originally employed it was mixed with oil and applied to smooth surfaced bearings; but though answering the purpose excellently for a while, it would creep out and escape and require constant renewals. This was obviated by the construction of grooved bearings, the grooves being filled with a composition of 75 per cent. graphite. The box requires no refilling and the bearings need no new application until the box is worn out. Graphite bushings of this kind were first applied in 1883, and are growing in favor, being now in very general use. Graphite is also used to a considerable extent for foundry facings and washes, also as a substitute for red lead in making joints and connections, having an advantage over red lead in that it does not harden, making a perfectly tight joint, that opens easily when the pipe tongs are applied. It is also said to make a good, durable paint for the covering of smokestacks, boilers, tin roofs and other metal surface. There seems, therefore, to be a favorable opening for the profitable development of our extensive resources of this mineral.

In the United States graphite is mined in Rhode Island, New York, Pennsylvania, Michigan and Wyoming, the total production in 1889, (see last census returns), amounting to 7,003 tons of crude ore. In Michigan and Pennsylvania the cost of production was in excess of the value of the mineral got.

Just as we go to press a despatch has been received announcing the resignation of Mr. D. J. Kennelly, Agent and General Manager of the Sydney and Louisburg, Coal and Railway Company.

The Nova Scotia Gold Fields form the subject of an excellent and valuable paper in the last volume of the Transactions of the Mining Association and Institute of Cornwall just come to hand. The writer is Mr. Symons, M. Inst., C. E., F. C. S. Numerous plates illustrating the occurrence of the mineral in various districts of the Province accompany the paper. Although slightly behind the times, the date of the paper being 1889, and therefore not posted up to date in the very notable improvements in milling practice that have since taken place, the data presented will be of service in directing attention to this excellent field for investment. The conclusions arrived at by Mr. Symons will be of interest to our readers. He says "Though the Nova Scotia gold fields can bear no comparison with the great gold fields of the world, they are very interesting from a geological point of view, and afford employment to a considerable mining population, who, together with the associated storekeepers make money. No country probably gives such a chance to the prospector to find a purchaser for his mine, as the gold is always in a visible state, and shows out well in large flakes and grains. There is still a great extent of gold measures unprospected which will afford a profitable field for native speculation during a long future. The climate is healthy, fuel and edibles are cheap, the population sober and quiet, and cost of machinery moderate. Although the gold fields are not of a character to satisfy large limited companies with inflated paper capital, most of the districts would yield remunerative returns to a fair system of mining with business-like management. Though the aggregate quantity of gold obtained may be considered insignificant compared with the production of other gold mining countries, yet the proportion obtained to the number of hands employed in this industry exceeds that obtained in any other country. A reference to the last column in the Statistical Table (quoted by Mr. Symons) will show that the value of the gold sold amounts to ten shillings per day per man, as against a wage cost of about five shillings, a percentage earning unparalelled."

The mineral resources of our great country have been occupying considerable prominence

in English journals lately. The Glasgow *Herald*, *Colliery Guardian*, *Iron and Coal Trades Review*, among other papers of influence and standing are noted in this regard. It is also gratifying to the REVIEW to see its humble efforts to direct attention to the value of the country reproduced in such mediums on the other side.

Mr. J. J. Childs contributes an interesting review of the mica industries. He says "During the years 1883 and 1884, when mica mining was in its most flourishing condition, the manufacturers of stoves consumed pro bably 95 per cent. of the product, and the fancy grades and large sizes of sheet mica which were then used found a ready sale at highly renumerative prices. Under this stimulus of large profits many surface deposits or pockets were opened by farmers or other individuals of small means who worked them occasionally when other business was dull and realized a considerable profit on their production. As long as the demand for large sizes continued this intermittent sort of mining could be carried on with a degree of success, but when the fashion of stove panels changed and small sheets were used in the place of the large ones, the demand for the latter fell off to a great extent. Mica suitable for cutting into large sheets was much less abundant than that available for small sizes; therefore lower rates had always prevailed for the latter, and careful, steady and systematic methods were necessary to produce such grades profitably. When the demand changed from large to small sizes the majority of miners were unprepared, through lack of capital or for other reasons, to adopt such methods. The result was a great reduction in the number of producing mines, and consumers were compelled to raise the price of mica or look to foreign sources for their supply. Another factor in increasing exportation (to the United States) came into existence with the extended manufacture of dynamos and other electrical apparatus in which a great deal of mica is used. The foreign article, especially that produced in Canada, was, on account of its superior cleavage, preferred to the domestic for this purpose."

Mica is used in two forms, sheet mica and ground mica, and the manner in which it is to be treated depends upon the form in which it is to be used. If it is to be sold as scrap for grinding, all that is necessary is to remove the adhering fragments of quartz and felspar and such parts of the mica as may contain foreign ingredients. If it is to be used in sheet form, the process is much more complicated, the blocks being first split into sheets thin enough to cut easily, then marked with a pattern of the size desired, cut along the lines marked, and the different sizes wrapped in paper and packed for shipment. There is a great amount of waste about this operation. The amount of sheet mica obtained does not usually exceed from 4 to 8 per cent. of the block mica treated.

The most common and well known use for mica is the panelling of stove and furnace doors. For this purpose the mica must be clear, free from spots, and of a uniform color throughout the sheet. The most desirable color is a wine red, and next to this comes white mica, which is nearly as valuable. Another important use is in the manufacture of electrical apparatuses, for which purpose its non-conducting properties render it valuable. The qualities required for this use are firmness of texture, toughness and ready cleavage.

There is a greater range of use for ground mica than for the mineral in sheets. And though the value of that part of the product made use of in this form is yet comparatively small, the many peculiar properties which ground mica possesses render it quite probable that its use will be widely extended. The difficulties to be overcome in grinding mica are considerable, and there are only two or three firms engaged in the business at present. Eight standard grades of ground mica are made. The coarsest of these are used to give frosted and spangled effects to the fancy grades of wall paper. The medium grades are employed in the manufacture of a lubricant for the journals of railway carriages, for heavy bearings generally, and for the axles of road vehicles. The finest grades are used in producing a uniform metallic white surface on wall paper, scrap mica for grinding must be white and as free from specks or colored matter as possible. Since any impurities in the scrap will affect the color and lustre of the product. It is also used for roofing cements.

The greatly increased demand for mica is noticeable in the phenomenal growth of the industry in Canada. Eighteen months ago the Villeneuve mine on the Lievres River, and Smith & Lacy, at Sydenham, Ont., were the only producers, and that only in a small way. To-day, in Ottawa county alone, close upon a thousand men are employed in mica mines, substantial works and plants have been put up and great development is going on in the Townships of Hull, Wakefield, Templeton and the other townships. A great deal of formerly worthless property has changed hands at good prices. The county is scoured by prospectors. The Lake Girard Mica Mining syndicate—probably the most extensive mica producing concern in the world—has within the year expended over a quarter of a million dollars in acqusition of lands, the erection of buildings, and machinery. The company employs close upon two hnndred men, and has forty teams on the road hauling the product from its various mines to an excellently equipped cutting and dressing works at Ottawa. Similar activity, although on not so extensive a scale, is noticeable in the Perth, Kingston, and other districts in Ontario.

Through the courtesy of Consul-General Lay, we are enabled to publish the following returns of the value of the exports of mica from the Ottawa district from the beginning of the year to the 15th of November :

MICA EXPORTS TO UNITED STATES

January reported		$3,140 90
February	"	2,432 07
March	"	5,371 03
April	"	3,203 98
May	"	4,639 55
June	"	5,631 19
July	"	6,560 26
August	"	6,352 31
September	"	2,837 75
October	"	5,088 45
November (to date) reported		1,952 03
Exported to United States via Brockville as per Consular returns		6,608 44
Exported to United States via Kingston, as per Consular returns		8,140 47
Exported to Great Britain ($179 being ground)		544 00
Exported to Germany, ground mica		485 00
Total value of exports so far reported		$62,987 43

Knud Sando, boodler-in-chief and grand mogul of that ill-starred venture the General Phosphate Corporation (Limited) does not seem content with the unenviable notoriety he has gained in Canada from the part he has played in the promotion and management of this enterprise, for he continues to air himself considerably in the columns of the daily press. One of his recent utterances is so characteristic of that parasite, the London Company promoter, that we give it in full. With unblushing impudence Sando says to the Montreal *Herald*:

"We have invested many thousands of dollars in Canada and the return has so far been of the most unsatisfactory character. We have had to meet the most unfair opposition and condemnation from quarters where we expected sympathy. It is to my mind most unjust that capitalists who invest large sums in Canadian enterprises should be so unfairly treated. We live in hopes that time will beour avenger.

For the actual facts our readers need only refer to the Corporation's mismanagement as given fully in our May issue, to the evidence in the case of Wills vs. Stewart, and to the data published elsewhere in this number. Sando's day of reckoning is not far off now.

Dr. R. W. Ells, of the Geological Survey, who spent last summer investigating the occurrence of our Laurentien apatites, has had a number of very fine photographs taken to illustrate his observations. A very fine set, beautifully painted by Mr. H. N. Topley, of the Department of Interior, is to be sent to the World's Fair. Dr. Ells has consented, with the concurrence of the Director of the Survey, to give a paper on the result of his studies at the forthcoming International Mining Convention.

It is understood that the Canadian Society of Civil Engineers will adjourn its annual meeting until the date of the Convention. The occasion of such a representative gathering of engineers is also to be taken advantage of by the McGill University authorities when the magnificent new engineering buildings now completed and equipped will be formally opened with befitting ceremony. This will form by no means the least attractive feature of a liberal programme being prepared for what promises to be a memorable week.

The impost of that iniquitous tax on powder magazines in Quebec is raising a rumpus among the miners, who rightly kick against paying the

enormous sum of $150 for the privilege of storing a minumum quantity of twenty-five pounds of explosive. It was hoped that, like the mining tax, this equally, burdensome measure would have been relegated to oblivion by the new Government. The inspectors seem bound to collect, however, and threats of an immediate enforcement of the law will be the *raison d etre* of the meeting of the General Mining Association, to be held at Montreal on Friday afternoon, 9th prox. As other matters of importance will be considered a large attendance of members is expected.

The Mining Society of Nova Scotia will hold its third Quarterly General Meeting in Halifax on the 8th prox. A good programme is being prepared by the Council. This Society, by the way, has just published a highly creditable volume of the proceedings at its June meeting and it is understood a second, embracing the business and papers of the Londonderry meeting, is in the press. All mining and scientific organizations should exchange with the Society. Its headquarters are Hollis street, Halifax.

It is understood that the Hon. Sir John S. D. Thompson, Minister of Justice, will shortly consider the petition presented by the coal operators of Nova Scotia, with respect to the disallowance of the coal royalty legislation.

Our attention has been directed to a letter in our last issue from a Sudbury correspondent reflecting upon R. H. Ahn. It seems that Ahn has not "skipped out" as surmised, but that he has been residing in Toronto. We cheerfully give space to the correction, particularly as his promised return to Sudbury gives rise to the hope of a satisfactory adjustment of his affairs.

One of the most valuable of the many excellent publications of the Geological Survey of Canada is the "Chemical Contribution from the Laboratory," issued from time to time by Mr. G. Christain Hoffmann. The Report just issued will be found most useful, indicating as it does by the published analyses of a large variety of ores and minerals the value of the great territory open to the prospector and miner throughout the country. Among the new minerals hitherto not identified as occurring in Canada, Mr. Hoffmann gives the composition of a sample of Danaite (an important form of Cobalt) found in the course of developing a deposit of nickeliferous pyrhotite in the township of Graham, District of Algoma, Ont. Gersdorffite (a rich form of nickel) is another new mineral which has been met with for the first time in Canada at the O'Connor claim on Lot 17, of the 3rd Range. Township of Denison. Other discoveries mentioned include Tripolite, or infusorial earth, of which an extensive deposit has been found at the head of Loon Lake, British Columbia. This material has been used by the Indians in the vicinity of Cache Creek for making tobacco pipes—a not inappropriate application in view of the facility with which it may be carved, its lightess and absorbent power. The opening up of this locality may lead to its employment for many purposes for which it can now be scarcely regarded as available by reason of the present difficulties and cost attendant upon its transport. A prominent feature of Mr. Hoffman's last volume is the very complete and important set of analyses of the brines from Manitoba and the Saskatchewan.

Knud Sando, has a great many "bees in his bonnet" just now, if one may judge by the record of his travels given by the daily press. We read of him having undertaken to promote a beautifully philanthropic scheme for the benefit of the benighted Homestead strikers—on the co-operative plan of course—and again still further south, of his having bonded mineral properties in Virginia, owned by a well known Canadian Senator. His other "kites" include the resurrection of a great super-phosphate scheme, and the construction of the Buckingham and Lievres River Railway. And this is the person to whom Lord Stalbridge, good, easy man, confidently entrusts the fortunes of the General Phosphate Corporation, with the assurance that "Mr. Sando having now assumed a position on the Board will henceforth devote his *whole time and attention* to the affairs of the company!" Bah! What fools these mortals be?

A new and important departure in company enterprises has recently made its appearance in the north of England. This is an association for the purpose of mining coal by means of electricity. The company will take the mines from their owners, install electrical coal-cutting and hauling machinery, and carry out the whole of the work in connection with coal production. According to the statement made in London *Lighting* they will charge a fixed contract price, probably about one shilling per ton. If it has an extended field, and to judge from the strength of the board and the warmth with which it has been supported there is every prospect that it will have, the effect upon the mining districts will be simply revolutionary. Electrical coal cutting is not only far cheaper than hand labor, but practically dispenses with it, so far as the cramping and stunting department of hewing is concerned. Thus an enormus number of outspoken and able bodied men are liable to be thrown out of employment unless the increased rate of production enables a correspondingly increased number of men to be employed in healthier work above bank. The list of the board representing this electrical coal-cutting contract corporation includes at present the names of Sir Archibald Campbell, Mr. Lindsay Wood (chairman of the Durham Coal Owners' Association), Mr. Frank Stobart (representing Lord Durham), Mr. James Knowles (of Pearson & Knowles, Wigan), the Hon. G. W. Winn and Mr. W. T. Goolden. It would be almost impossible to put together a more influential or representative syndicate, and the effects of its formation upon the industry will be watched with great interest.

The heaviest armor plate ever made is in course of preparation at the Bethlehem (Pa.) Iron Works. The monster ingot, which will be converted into armor plate, is now in a furnace in the hammer department. It weighs 84 tons, and when completed will be seventeen inches thick. This armor will defend the side of the battleship Indiana, now building at Cramps' shipyard, Philadelphia. The Carnegie company, of Pittsburgh, secured the contract for this work, but being unable to make armor more than thirteen inches in thickness, the contract was given to the Bethlehem works in exchange for lighter work.

The Ordnance Bureau of the United States Navy Department has completed specifications for armor plate required for the two new vessels authorized by the last Congress and to finish the battle ships and other armored vessels already building. Advertisements inviting proposals for furnishing this armor will be issued from about 7,000 tons, at an estimated cost of $4,000,000, will be called for. This will be the largest armor plate contract ever let by the department. It is understood that nickel steel treated by the Harvey process of surface decarbonization will be called for, or at least the bulk of it. Nearly all the new ships are being delayed through lack of armor material. Up to the present time the Carnegie company has furnished only 650 tons out of 5,900 tons contracted for, including the 400 tons of diagonal armor for the battleship Massachusetts, just completed by the Bethlehem Co., they have delivered only 1,000 tons of their 5,310 ton contract. The thickest plate for side armor to be called under the new contract will be 14 inches. This is a reduction of four inches over the side armor of the three battleships building, the difference representing, in the opinion of Commander Folger, the increase in the resistance of a Harvey plate over the untreated nickel steel.

The enormous number of mining companies that have lately been floated point many a moral and emphasize many a tale of wrong and disaster. The injury done to individual speculators who have sustained losses has had a prejudical effect upon the mining industry as a whole by converting many mining investors into bitter scoffers, who now only shower anathemas upon an industry to which they previously devoted their gold. That matters connected with the mining industry are considerably out of joint has frequently been pointed out, and the necessity for reform in the law relating to the flotation of mining companies is apparently quite as pressing as in the matter of the conditions under which the actual work of mining has to be carried on. The point which is specifically in mind at the moment is that of making some provisions which will insure the appropriation of a substantial percentage of the money subscribed by shareholders to the real work of mining. As matters now stand, too much of the money extracted from the pockets of investing public is passed over to and retained

by the few fortunate people who happen to get in "on the ground floor," and too little is devoted to the purpose for which the various companies are ostensibly floated. There is no objection to the original owners and vendors of a mining property securing a good price for that which they are handing over to a company, but let their reward be dependent upon the ultimate success of the company. It is too often the case of scuttling out as soon as the property is out of hand, and one would like to see legislation framed with the object of putting a stop to the wild-cat company mongering that has in the past proved so profitable to a few unscrupulous harpies, and so injurious to the mining industry itself. This legislation should, take the form of a special provision that the cash paid for shares should be spent in the development of the property floated. This would at any rate do something to minimize the evil, and would insure a fair trial for many a property which would otherwise be relinquished for want of funds when success was almost within grasp.—*Black Diamond.*

CORRESPONDENCE.

Notes From East Kootenay, B.C.

SIR,—Once more grim winter is upon us, and the earth is covered with its snow white mantle, from the tops of the highest mountains to the bottom of valleys. All the claims in this district are now shut down for the winter, even the "Lanark" which has hitherto given work to from ten to a dozen men every winter for the last four years, is idle, and under the charge of a caretaker.

This cessation from work is not from any failure in the value of the properties, but simply a rest, before commencing with renewed activity in the spring. There is talk of large developing works being commenced then, and each claim that has changed hands this year will receive a good testing next year. So be it! As far as can be judged on the work done on the claims here to date, all prove that they increase value, and also that the deposit increases in width as greater depths are reached. This is sufficient to spur claim-holders on to further development, if they are imbued with the necessary enterprise, and if they have the means to carry out the work needed. Development of claims means expenditure of money, and labor, and the intelligent application of both to ensure success. The field is in no sense a "poor man's diggings," and though a good many claims are sold for speculative purposes, by simply doing the assessment work required by the mining laws of British Columbia, usually all show well from the surface indications, and are mostly held by old prospectors, who have been in the district for some time, and who elect to stand or fall by their different shows. The same complaint obtains now, as it did some years ago, and that is that too high a value is placed on prospects, which has the effect of keeping many from purchasing who otherwise might be willing to take hold; although there is now a marked improvement in the direction of more moderate prices. A "prospect" however good, is not a mine, and simply an indication that there may be a deposit of workable material, therefore to ask such prices as have been demanded in the past has a deterrent effect on the development of many a promising "show," and has had a natural tendency to keep the district back. Let us hope that wiser action in the future may characterize holders of mineral claims. Let them be satisfied to part with them to those who are able, and willing to develop them at 'prospect' figures; then will there be a probability of money coming in, and work being carried out.

Looking back at the events of the past season a great step forward has been made. Foremost amongst others has been the shipment of test lots of ores to the Old Country for the purpose of analyses under the personal observation of those who have made investments. In June a shipment of eight tons was taken from the "Jumbo" owned by Messrs. Corbin, Kennedy, Ross & McDermid, and forwarded to Scotland for treatment. The ore was taken from the mine and packed on horses to Illecillewait, under the personal supervision of Mr. Lynn, C.E., on behalf of the Scotch firm, and Major Word Kennedy on behalf of the owners of the "Jumbo." The ore was then packed, under the superintendence of Mr. A. Grant, who acted for both parties, into casks for shipment, each cask averaging 800 pounds in weight. Thus every precaution was taken by both sides to have a fair and impartial test of the mine, and all doubts as to the genuineness of the product were guarded against on every hand. Later on in October, the British North America Development Company made a shipment from several of the properties they have invested in this summer. The "Blue Bell," the "Goat Cave," the "Mennick," the "Maddelina," the "Nith," and the "Youchan," were represented, half ton lots from each claim were forwarded to London for treatment. This ore was also packed in bags and sealed by independent parties, one being Mr. Frank Owen, of the firm of Owen & Gannan, mining brokers, of Golden, and the other a Mr. Harrision from England, one of the directors of the company. Horse trails had been cut, and all the necessary work in opening the various properties and getting the ore ready for shipment, were made under the personal supervision of the superintendent. A step has been made in the right direction, and it is to be hoped this practice will be universally followed in the future. We should then hear no more of salted mines, and the revelation of bare-faced swindles like that in Idaho, recently come to light, would be rendered impossible. In this instance $1,000,000 was paid for a salted mine by English capitalists, with the result that the property proves to be worthless, and American mining properties have received another set back on the English market. English people unfortunately too often confound Canada with the States, and our country is indiscriminately referred to as the "America." A swindle of this sort thus reacts on Canadian properties as injuriously as if the swindle had taken place in Canada. In the face of a falling silver market, and the general feeling of insecurity with regard to the standard value of silver, matters of this kind have a disastrous effect on mining enterprise, and should be reprobated by everyone who has the welfare of the mining industries of this country at heart, and who wishes to see them prosper and flourish.

If before purchasing right out any mineral property, investors made it a condition of sale, that fair average tests of quantities of ore, sampled under the personal supervision of impartial, and independent parties were made, there would at once be an end to the carrying out of such practices. No one could salt tons of ore, however ingeniously and artfully ore may be salted for assay or inspection. Consequently the test of shipment is better and fairer for both prospector, miner, and investor, and places each one on a surer footing.

The only objection that can be urged is delay, but where the seller is sure of ascertaining the value of the property, he need not chafe at this. It is satisfactory to note these instances of a determination on the part of investors to have a fair test of the value of the property before paying the full purchase money. The sellers are fully convinced that the test will prove that the properties are even more valuable than claimed. In each case a certain amount of money has been paid down, so if the claims should not be taken over afterwards, the claim owner is no loser by the transaction, but will have a better idea of the value of his property. In connection with this matter there is another most important factor in the development of this district, and that is the heavy charge of the C.P.R. for freight. It is well known that the expense of this road in the mountains is heavy, but it is to be hoped for the future welfare of this part of the Dominion, that the authorities of the C.P.R. will meet the needs of the mining community of these regions in a liberal spirit, as the traffic in goods and machinery increases. Or else we shall have one of our greatest industries in the future so heavily handicapped, that it will have only a languishing instead of a strong and vigorous growth. The C.P.R. is making a collection of speciments from every mining claim in Kootenay district for exhibition in their London office in King William street, one of the busiest thoroughfares in the great metropolis, and this will draw a great deal of attention to the valuable resources of this section of the country, from the moneyed classes of that great city, and will doubtless lead to investments, particularly when they find they are welcome to have a trial test of the ore under their own immediate supervision.

There will be a very strong Canadian company in the field next season, to work Messrs. Ryckman & Scott's properties in Fish Creek, and the valuable copper deposits at the head of Caribou Creek. Vigorous work will be commenced as soom as practicable in the spring, with both men, machinery, and the indispensable adjunct of ready money. The B. N. A. D. Co. will also push development work on their properties. Messrs. Fishburn & Co., in Fsh Creek, and Messrs. Forbes & Co., of the Golden Smelter Co., will push work on their properties in Fish Creek, and Illecellewaet, notably the "Dunvagan," and the "Gladstone," so that if there is an early season there will be a prospect of a lively and bustling stir in every direction. After a long spell of enforced idleness as it were, this district is slowly but surely waking up, let us hope to a continued and permanent activity.

E. A. WATSON.

Illecillewaet, 13th November, 1892.

New Brunswick Mining Notes.

SIR.—The fact of their being a scarcity of mining notes from this section of any importance must account for my long silence. The turmoil and uproar of a local Provincial Election has made us all forgetful of other important matters for a time.

It might be well here to say that, at the last session of the Provincial Legislature an amendment to the Mining Act was passed which in the case of any mines being actively and regularly worked all royalties are exempt for the space of five years which will, no doubt, be of some interest to those who might be induced to invest in mining claims in N. B.

Since I last wrote you a number of capitalists have been looking over and talking of making a start on the supposed nickel areas at St. Stephen, but either owing to extravagant prices being asked for properties, or some unknown reason, no positive effort has been made to have them opened up, though the ore is regarded as being valuable and in large quantity.

The records of the mining office show a large number of areas to have been taken up in various localities in the Province, but no actual amount of development has as yet been made.

The Manganese industry of Sussex and Markhamville, I regret to say, is still dormant and the expenditure of money that for years was usual in the Markhamville district is much missed by both miners and farmers.

In Albert county, the Alma Copper Company has done considerable work in trying to develop and discover the true lead of copper, which is supposed to exist there. The samples shown by the company's officials, are very rich indeed and seem to warrant the work of exploration which is being made. It is to be hoped they will meet with success in their efforts.

Near Hopewell Hill, a Mr. Van Melin is opening up a promising deposit of Manganese, which bids fair to be of a remunerative character. The ore is said to be of very high grade. Several development companies have been formed in various points of the Province to prospect for coal, gold, and other minerals, but the full details are not as yet known.

In Albert county a very fair showing of Albertite coal has been found on an area controlled by Chas. A. Peck, Esq., of Hopewell Hill, who is anxious to enlist capital in the enterprise. The Albertite coal at the time of the working of the Albert Mines some years ago, was regarded as one of the most valuable mining industries in the Province, and from which hundreds of thousands of dollars in dividends were had by the shareholders.

In Gloucester county, near Bathurst, some considerable work was done at the instance of a Mr. McNichol, of Calais, Maine, on a gold and silver belt, and the developments were so satisfactory that English capital has been interested, so it is stated on good authority, and the chances are a large and profitable mining industry will be established. The ore is principally silver and gold, the most satisfactory tests having been made by Professor Donald, of Montreal, a thoroughly competent authority. The values of these ores run from about $30, to upwards of $150 per ton. The ore vein being 27 feet wide. The owners of the property, Bathurst men, are to be congratulated on their future good prospects.

At several points in the Province, good deposits of Galena ore, Copper ore, Plumbago, Manganese, Antimony and iron ore await the coming of the capitalist.

Any investor or investors interested in salt production from brine springs, can find an opportunity to invest in such on most reasonable terms, in a central and important point in New Brunswick, and which, beyond doubt, in the hands of men of capital could be made highly remunerative.

Recently quite an amount of capital has gone out of the Province in the opening up of mining properties in Nova Scotia, Mexico, &c., and while of course, investors have the right to please themselves, it seems too bad that the same degree of interest cannot be had in connection with mining exploration and development in our own Province.

There being nothing further of interest to write of at present, I will conclude, promising to keep you posted as well as I can on any new developments which may arise.

Yours, &c.,

CRYSTAL.

Fredericton, N.B., Nov. 21st, 1892.

Modified Koepe System of Winding.—The Koepe system of winding, but in a modified form, devised by M. de Mot, has been adopted at the Moulin pit, Gilly, Belgium. The pit is to be deepened to 940 yards, but it now has insets at four levels ranging from 180 to 855 yards. The output is 300 tons daily with 75 tons of dirt. A six deck cage for six tubes is used, the cage and tubes weighing 3.7 tons. The Koepe system has been adopted; only two ropes are used instead of one. Each rope passes around its own groove on the drum and pit-head pulleys, their ends being connected to the cage by chains, so that one rope could support the cage if the other broke. Each rope has a factor of safety of six by itself, and the higher safety is thus attained at a less cost than it would be by a single rope. In addition the crushing effect on the lagging of the drum is greatly reduced. The drum is made from one of the original flat rope reels by fitting it with a rim originally 23 feet in diameter, but subsequently reduced to 16½ feet. It was lined with grooved beech blocks ⅞ inches thick, the grooves being 7.8 inches apart and ⅛ inch broad. Horizontal winding engines are used. The steel wire ropes are 1.61 inch in diameter, with eight strands containing 19 wires of 0.866 inch diameter, and having a tensile strength of 87.6 tons per square inch. The balance ropes below the cages are of galvanised wire, with a tensile strengh of 45 to 50 tons per square inch. This system has been in successful use since August 1889.—(Minutes of Proceedings of the Institution of Civil Engineers, vol. 107, pp. 523-525.)

The General Phosphate Corporation.

A Flood of Light Thrown on the History of Affairs in London—Alarmed Shareholders Refuse to Pay up their Calls and Enter Suits—Promoter Sando's Wildcat Schemes—An English Shareholder Visits Canada, Investigates for Himself and Denounces the Board as a Parcel of Knaves or Fools—The Company Doomed.

With this month terminates the second financial year of the General Phosphate Corporation (Limited). For reasons best known to the directors, however, no meeting of shareholders will be held in all liklihood before the new year. A lively time is promised. A syndicate of shareholders, who refuse to pay up their calls, on the ground that the statements contained in the prospectus were false and misleading, have repudiated their calls, and issued Writs against the company so that the whole ill-starred career of the venture will soon be ventilated in the courts. Our readers are well posted with the history of the Corporation. Its promotion, organization and collapse have been repeatedly commented on in the REVIEW. Our articles have been widely read and have been instrumental in directing attention on the other side to the true state of affairs. For the first time however we publish in this issue the history of events in London as revealed by the circular-letters and other memoranda that have passed from time to time between the dissentient shareholders and the Board. These have been kindly furnished by a friend in London. They clearly indicate that the directors have been blinded to the facts. Someone, probably Sando, has been throwing dust in the eyes of these gentlemen.

EARLY PREMONITIONS.

23 COLLEGE HILL, CANNON STREET,
LONDON, E. C.

To the Shareholders of the General Phosphate Corporation, Limited.

GENTLEMEN,—As many inaccurrate and misleading statements are being made upon the position and prospects of the Corporation, the directors think it desirable to put the shareholders in possession of authentic information upon the subject.

Two properties known as "High Falls" and "Ross Mountain," situate near Buckingham, Ottawa, Canada, have been purchased and transferred to the Corporation. These properties have a total area of 2,660 acres.

Mr. George Stewart, one of the vendors, has made arrangements with the Corporation, under which he guarantees an output of 10,000 tons of high grade ore during twelve months from the fixing of the machinery, which ore is to be delivered free on the wharf at Montreal, at a maximum cost for mining and transport of $9 per ton.

The mining arrangements will be subject to the supervision and direction of Mr. J. Lainson Wills, who has been appointed representative and engineer on behalf of the Corporation, and he will also certify as to the cost of mining and transport.

The directors have retained control over £10,000, part of the purchase money, which will not be paid to Mr. Stewart until his guarantee is performed.

Active mining operations commenced in November, 1890, machinery is on the ground, and huts have been erected for the workmen.

The directors have instructed Mr. J. Lainson Wills to forward regular reports as to the working and development of the mining operations.

From information which has been received by the directors, they believe that the "High Falls" and "Ross Mountain" properties are two of the finest properties in the before-mentioned district of Canada.

They have further been advised that when the two properties are in full work they will be able to produce 20,000 tons of high grade ore per annum.

The directors have also entered into negotiations with a director and representative of a Canadian Company, who is now in England, for the sale to such Company of all low grade ore to be produced from the properties now owned by the Corporation up to a maximum of 25,000 tons of ore, the Canadian Company to be under an obligation to take delivery of at least 10,000 tons per annum.

The price to be paid by the Canadian Company will, in the opinion of the directors be sufficient to discharge all working expenses at the mine in respect of both high and low grade ore (with the exception of the Manager's salary) and to leave a small margin of profit beyond.

The directors do not at present propose to purchase and hold on behalf of the Corporation any other properties than those already mentioned, believing that the output from these two properties alone should at present prices be sufficient to pay a substantial dividend on the present paid up capital of the Corporation. They have, however, received offers for the purchase of good properties on very reasonable terms, but have not felt justified in making arrangements for additional purchases at the present time.

In arriving at this conclusion, the directors have been guided by the statement in the prospectus, which was repeated to the shareholders at the general meeting in September last, that they did not propose to make a call beyond £2 per share already paid up.

The directors cannot of course pledge themselves not to make any further call upon the shareholders in the future, because circumstances might arise which in the interest of the Corporation would necessitate their doing so. But under present circumstances they do not consider that a further call will be required, and they see no reason to alter or modify the statements which have been previously made on the subject.

Whilst, however, the directors have come to this conclusion, they consider it most desirable in the interests of the shareholders that further additional properties now under offer to them should be at once purchased, with a view of either working them themselves or of their being resold at a profit to companies formed for the purpose of acquiring them.

If this were done not only could immediate profits be made, but the directors would be able to carry out their wishes of securing a strong and leading position in the phosphate market, as, in their opinion, the phosphate industry is destined to become a very thriving and important one in the future.

With these objects in view, the directors propose to take steps for obtaining further subscriptions to the capital of the Corporation, and for making an issue of debentures.

The proceeds of these issues will be devoted to the purchase of additional properties, with the view of either working them themselves, or of re-sale to other companies on the lines indicated above, and to the expenses consequent thereon.

In order to carry out this policy, the directors and their friends are prepared to at once increase their present holdings, and they hope the shareholders will do the same to assist in bringing to a successful issue the arrangements they propose making.

Forms of application for shares are enclosed with this report, which the dirctors hope will be filled up by yonrself and your friends, and be returned to the Secretary, or forwarded to Lloyd's Bank in due course.

By order of the Board,
L. J. LANGMEAD,
Secretary.

31st December, 1890.

THE FIRST "KICK."

16 ASHBURN PLACE,
SOUTH KENSINGTON, May, 1892.

To the Chairman and Board of Directors of the General Phosphate Corporation, Limited.

GENTLEMEN,—As a co-shareholder with yourselves in the above company, I think it is only a duty to bring to your notice the following :

There are numerous rumors afloat in connection with the purchase by the company of certain properties in Canada from Messrs. Colby & Stewart.

1. Both the properties said to have been purchased were, within a recent date, offered in the London market at a sum under £10,000, and that the company have now been induced to give for them a sum approaching £90,000.

2. That the vendors, out of the purchase money, have, in one way or another, promised commissions exceeding the sum at which the properties were originally offered.

3. In connection with these commissions, it is reported that certain securities of the company have been negotiated in London.

4. That a large part of these commissions goes to certain persons engaged in the promotion of the company, and has to be shared by them with certain officials in order to bring about the purchase and sale of the properties.

5. I hear further that one of the conditions of a contract with the vendor is that a certain number of tons of "high-class phosphates" shall be mined during the first two years. That "high-class" is defined to mean mineral of 70 per cent. and upward of phosphates ; while the term "high-class phosphates" in the general market means mineral yielding "80 per cent. and upward." If this is the case, it is calculated to mislead greatly in forming estimates of probable profits for losses.

I have, as a shareholder in the company, to bring these matters before the Board, in order that if the Board is able to trace any truth in these rumors, the contract may be cancelled before it is too late to save the shareholders' money.

You will understand that this communication is entirely private and confidential, as between shareholders jointly interested in the undertaking.

I am, gentlemen, your obedient servant,
(Signed) ARTHUR BARFF.

June 6th, 1891.

P.S.—Since I wrote the above, I have received a prospectus of an issue by the company of £100,000, 6 per cent. debentures, charged upon the uncalled capital.

I have now read the contract between Mr. Stewart and the corporation for the sale of the property known as "High Falls," which seems to confirm some of the rumors mentioned above, viz. :—

That contained in paragraph five of my letter, that the phosphate which the vendor guarantees to deliver does not come under the class "high grade," and here I would remark that the paragraph in your prospectus this morning, referring to this point, is liable to the charge of being misleading.

A. B.

THE BOARD REPUDIATES THE BARFF CHARGES.

12 UPPER BROOK STREET W., 9th June, 1891.

DEAR SIR,—I only returned to town late last night, and on my return found your letter.

I have been informed to-day that your letter to the Chairman and Directors of the General Phosphate Corporation has been sent not only to the chairman and directors, but also to shareholders, although it is headed "private and confidential."

Under these circumstances I am afraid that I cannot answer you as freely as I would otherwise have done, but I should have been glad to have pointed out to you the mistakes into which you have fallen.

After your visit to me at Euston, I did satisfy myself on several points to which you drew my attention, but I cannot now make any further communication to you privately as your letter will doubtless be answered by the Board in the course of a few days.

I am, yours faithfully,
STALBRIDGE.

ARTHUR BRAFF, ESQ.,
16 Ashburn Place,
Cromwell Road, S.W.

23 COLLEGE HILL, CANNON STREET,
LONDON, E. C., 12th June, 1891.

To the Shareholders of the General Phosphate Corporation, Limited.

GENTLEMEN,—A circular by Mr. Arthur Barff (a shareholder) was received by Lord Stalbridge on the 8th of June, 1891, and replied to on the following day.

The circular letter and reply (copies of which are enclosed for your information) were considered by my directors, at a board meeting held on the 10th of June, 1891.

My directors have instructed me to reply in detail to the statements contained in Mr. Barff's circular.

As to paragraph 1.—The Board have ascertained that there is no truth in this statement. (See copy letter from the Hon. C. C. Colby, late President of the Privy Council, Canada, and copy cablegram from Mr. Geo. Stewart, just received, enclosed herewith.)

As to paragraphs 2 and 3.—The Board have not, and cannot have, any information on the subject, and have requested Mr. Barft to supply them with specific details.

As to paragraph 4.—The Board have no knowledge whatever of the facts alleged in this paragraph.

The statement as to commission being shared by the vendors with certain officials, &c., seems to the Board a matter capable of specific detail, and they have requested Mr. Barff to supply them with the information in his possession, and the names of the officials referred to.

As to paragraph 5.—Under the contract with Mr. Geo. Stewart, one of the vendors, he is under obligation to produce 10,000 tons of phosphate ore, containing not less than 75 per cent. of phosphate upon an average, in accordance with the terms and conditions of such contract. The Board consider there is no doubt that phosphate ore of this average per centage is high grade.

Four samples of ore produced by Mr. George Stewart, in pursuance of the terms of his contract, have reached this country, and have been analysed on behalf of the Corporation. The result of such analysis is as follows :—

1	2	3	4
76·73.	80·45.	82·26.	82·41.

The Board desire to add, for the information of the shareholders, that several hundred tons of ore, represented by these samples, are in course of shipment, and it is expected that regular shipments will now be made.

The directors much regret to put the Corporation to the expense of a circular in reply to the statements made by Mr. Barff, but they consider that the shareholders would have wished them to do so in order to allay any possible feeling of apprehension that might have been entertained on the receipt of such circular.

I am requested to point out that only 13 shareholders out of a total number of 326 thought it worth their while to comply with the request made to them by Mr. Barff of communicating with my directors upon the subject matter of his circular.

I am, Gentlemen,
Yours faithfully,
L. J. LANGMEAD,
Secretary.

VENDORS COLBY AND STEWART ALSO HEARD FROM.

64 MARGARET STREET, CAVENDISH SQUARE,
LONDON, June 10th, 1891.

Mr. L. J. Langmead, Secretary the General Phosphate Corporation, Limited.

DEAR SIR.—A printed copy of a letter addressed by Mr. Arthur Barff to the chairman and directors of the General Phosphate Corporation, Limited, was received by me yesterday.

The rumors to which reference is therein made, so far as they relate to properties which I sold to your Corporation, are absurdly erroneous.

I sold to the Corporation three distinct groups of valuable phosphate properties, of which the aggregate area was more than 1200 acres.

For a single property containing 123 acres, which is included in one of the groups, I paid to the previous owner, in net cash, more than £10,000, and bought it as I believe very much under its value.

I desire to give an unqualified contradiction to the statement (1) in Mr. Barff's letter, viz., that "both the properties were, within a recent date, offered in the London market at a sum under £10,000." The properties which I sold to the Corporation were never offered to any other party in London or elsewhere at any sum whatever with

my knowledge or authority, and no person could properly offer them without my knowledge and authority.

I have not seen the properties sold by Mr. Stewart, but judging from the favorable opinions of them held by persons in Canada, who are well acquainted with them, I cannot believe that they could have been offered for a sum so much below their value as £10,000.

The statement (2) concerning the amount of commissions promised, &c., so far as it may apply to the properties which I sold, is also untrue. From the falsity of the above I am quite prepared to disbelieve the other statements relating to commissions, &c.

Indeed it is very clear to my mind that whoever gives credence to those rumors, most of which I know to be false, is misled by ignorant or evil-minded informants.

Very truly yours,
CHAS. C. COLBY.

Received the following American telegram, on the 11th June, 1891, at 5:47 p.m., from Buckingham Station, Quebec, via Direct Cable :—

To the General Phosphate Corporation, Limited, 23, College Hill, London.

"The property you purchased from me was never offered in London as low as sold to you. Shareholders can't prove to the contrary.

"GEO. STEWART."

BARFF BOUGHT OFF — DUNCAN AND KEMBLE AND CRAWLEY ON THE WARPATH—THE "REVIEW'S" ARTICLE SENT TO THE SHAREHOLDERS.

LONDON, E. C., June 4th, 1892.

To the Shareholders of the General Phosphate Corporation, Limited.

GENTLEMEN.—As allottees of shares in this concern, applied for on the faith of the Company's prospectus, we venture to address you with a view to some combined action for our common protection.

In May of last year, Mr. Arthur Barff issued a circular with regard to the company, showing that the properties should have been acquired for a very small sum compared with what the company paid for them. That the prices paid had been so enormously swollen to enable commissions to be paid by the vendors for division amongst the promoters and their associates, and that it was quite hopeless to expect that the company could work such properties at a profit. The accuracy of Mr. Barff's statements was promptly denied by the directors, but, nevertheless, we believe them to have been substantially correct, and we point to the significant fact that Mr. Barff is no longer a shareholder, having been relieved of his shares by a director.

In our opinion, even if the circumstances under which the company was started were as held out to us, the directors ought never to have gone to an allottment upon the meagre subscriptions they received from the public, as their doing so involved the acceptance of the personal responsibility of one of the promoters for no less a sum than £31,000.

After careful enquiry and investigation we have obtained evidence which satisfies us that the prospectus contained not only suppressions of the truth but also misrepresentations of material facts, and we consider that all persons who applied for shares on the faith of the prospectus, and in ignorance of the true facts, are entitled to repudiate their contract to take shares if they elect to do so without delay. As you must be aware from the balance sheet and report of January last, the company is heavily indebted for debentures issued at a ruinous rate.

This debenture debt which has been raised mainly on the security of the uncalled capital may at any moment force the company into liquidation, and it must be borne in mind that under such circumstances the liquidator would at once proceed to enforce payment of the shareholders' liability. The risk which shareholders are at present running is, therefore, very serious and they will have themselves to blame if they do not take prompt steps for their mutual protection.

The company's prospects of ultimate success we believe to be absolutely hopeless, and we should feel obliged if you would reply to this circular by letter directed to either of us at our address as below, stating whether you are prepared to join with us in our endeavor to escape further payments. and if possible, to recover the money already parted with by you and us and in such case to contribute rateably to the necessary expenses, which will be kept down to as low a point as possible, but before any expense is incurred, we propose to hold a meeting of those who are interested in the question and come to an arrangement as to what should be the extent of our outlay.

If a fair number of shareholders join us, the cost pro rata would not be heavy.

Yours faithfully,
W. W. DUNCAN,
An allottee of two founders' and 100 ordinary shares.
S. C. KEMBLE,
An allottee of two founders' and 100 ordinary shares.

Kindly reply to

W. W. DUNCAN,
St. Stephen's Chambers,
Telegraph Street, London, E. C.,

or S. C. KEMBLE,
14 St. Mary Axe, London, E. C.

20, WHITEHALL PLACE, LONDON, S. W.,
18TH JUNE, 1892,

To the Shareholders of the General Phosphate Corporation, Limited.

GENTLEMEN.—You will, I presume, have received, as I have, a circular from Messrs. Duncan & Kemble, dated the 4th inst., and, if you attended the general meeting in January last, you will have heard remarks from me somewhat to the same effect.

Shortly after Mr. Barff's circular was sent out the shareholders received from the directors copies of letters or telegrams, addressed to the company by the two vendors, Messrs. Colby & Stewart, contradicting Mr. Barff's statement as to the prices at which the properties had been bought by the company and the prices at which they had been previously offered in London. Mr. Stewart stating that his property had never been offered in London at a lower price than that at which it was sold to the company.

As to this I may say that I have been recently in communication with an agent who was interested in the sale to the company, and he told me distinctly that, on Mr. Stewart's behalf, he had previously offered the property in London at a lower price. In order to bring about the sale of his property to the company, Mr. Stewart had to pay commissions to various people, and I know that the commission paid by him to Mr. Sando (the principal promoter of the company) alone was £11,000.

What Mr. Stewart eventually cleared, after the payment of the various commissions, I cannot say; but, whatever balance of the £40,000, paid for the property, remained in his hands, one may be quite sure that his profit was more than it would have been if the property had been sold in a straightforward manner, and the value of it properly checked.

Those of the directors who really were in ignorance of what was going on must by this time have discovered that they have in fact given about ten times as much for the properties as they were worth, or could have been obtained for by a private individual for cash and, in fact, I obtained this information as to values, in the first instance, from agents who are now advising the directors, and who manage, and, I believe, partly own, adjoining properties.

I have recently had an opportunity of conferring with a Canadian gentleman engaged in the phosphate industry, and he tells me that in Canada the fact that the shareholders have been defrauded is notorious, and that all honest proprietors of properties for sale are disgusted with the affair, as they fear that it will have the effect of stopping for many years the flow of English capital into Canada, for purposes connected with legitimate enterprise, and he offers to obtain for the shareholders plenty of proof of his statements.

I cannot, within the limits of a letter, go into the many other points connected with the matter, but must leave them until a meeting of shareholders has been called.

I am, gentlemen,
Your obedient servant,
R. F. CRAWLEY.

P. S.—Since writing the above I have received from Canada another offer of assistance in exposing the proceedings of the promoters and the company's officials out there, and a copy of the "Canadian Mining Review" for May, containing an article on the subject, which I commend to the perusal of shareholders. [The REVIEW's article of May reproduced in full accompanied Crawley's letter to the shareholders.]

STILL BLINDED TO THE FACTS—LORD STALBRIDGE EULOGISES "BOODLER" SANDO.

25, COLLEGE HILL, LONDON, E. C.,
JULY 4TH, 1892.

To the Shareholders of the General Phosphate Corporation, Limited.

Since the last general meeting of the Corporation nothing has transpired of sufficient importance to cause me to trouble you, but in view of the persistent attacks made upon the Corporation by three or four shareholders, I have deemed it advisable at this stage to address you.

It has come to the knowledge of the Board that circulars have been sent to you by Mr. Crawley and Messrs. Duncan and Kemble. Until quite recently all these gentlemen were in arrear in the payment of the calls on their shares, but Mr. Crawley has within the past few days, and on the eve of trial of the action which the Corporation had commenced against him, submitted to an order for payment of the full amount of the Corporation's claim for calls, with interest and costs. As in this action Mr. Crawley alleged that the prospectus contained untrue and fraudulent statements, his failure to continue the proceedings should be considered satisfactory to the general body of shareholders.

Actions are pending against Messrs. Duncan and Kemble for the recovery of the amount due by them for calls on their shares, and after canvassing for evidence to support the contentions contained in their circulars, now appeal to the shareholders for funds to pay costs in fighting the Corporation. These actions must shortly come before the courts, when Messrs. Duncan and Kemble will have an opportunity of substantiating their allegations, and they must either do so (whether the shareholders support them or not) or pay the amounts claimed.

While here denying all imputations made concerning the administration of the Corporation's affairs, I wish to point out that you are already in possession of all the facts within the knowledge of the Board.

Mr. Sando has been attacked by the gentlemen above named, and I must say, in justice to him, that he carried out his contract with the Corporation to the satisfaction of the Board, and has always shown his willingness to assist in making the Corporation a success. On behalf of myself and colleagues, I deny that he has used any influence with the Board to the detriment of the Corporation.

We have considered him the proper person to assist in the management of the Corporation's affairs, and upon my recovery from a very serious illness, following immediately after the annual general meeting, he was elected a director, and requested to proceed to Canada in order to settle certain disputes which had arisen between the Corporation and Mr. J. Lainson Wills, the Engineer, and Mr. Stewart, the Contractor.

The result of such visit has been that Mr. Alexander Benson, who is highly recommended as a thoroughly practical Mining Engineer, has been appointed at a salary of £300 per annum, in the place of Mr. Wills, to whom the Corporation was paying a salary of £1,000 per annum.

Other important alterations have been made in the management and working of the mines.

Mr. Sando succeeded in procuring the passing of an Act through both houses of Parliament in Canada, granting to this Corporation a charter to construct a railway through the phosphate district, the value of which can hardly be over-estimated.

He has only recently returned to England, after an absence of over three months, upon the affairs of this Corporation. At our last Board Meeting he was elected Managing Director of the Corporation, and he will, in future, give his time and energy to its business.

The Board have no reason to change their previously-expressed opinion as to the value of the properties, for not only are they very rich in phosphate, but there are good indications of valuable deposits of other minerals, particularly mica, which latter is of increasing commercial value.

It is a matter of regret, however, that the present depressed condition of the phosphate market has so long continued.

I remain, yours faithfully,
STALBRIDGE,
Chairman.

These circulars convey a fairly good idea of what has transpired in London. Since these were sent to press one of the shareholders, bent on investigating matters for himself, has been in Canada. Learning that Mr. Shields, (of London), the gentleman referred to, was in Ottawa following up his enquiries, the REVIEW called at the Russell and succeeded in ascertaining his views as follows :—

INTERVIEW WITH SHAREHOLDER SHIELDS.

Q. You are a shareholder in the General Phosphate Corporation? A. Unfortunately, I am.

Q. Do you know anything about phosphates, particularly our Canadian industries? A. I know a good deal now, but my experience has been gained entirely in investigating the affairs of the Corporation, and I may say, mainly since I arrived in Canada. When I applied for shares I knew nothing about Canadian phosphates.

Q. What induced you to think that the Corporation would be a good investment? A. Principally the fact that Sir James Whitehead and Mr. Sampson S. Lloyd were on the board. The firm of Whitehead, Halsted and Chown were my brokers. Perhaps, too, I was a wee bit carried away by the tremendous array of founders.

Q. Sir James Whitehead did not remain long on the Board? A. No, he retired immediately after allotment, I think.

Q. For what reason? A. I think you will have to go to Sir James himself for an answer to that.

Q. Was it not openly stated in the columns of the London financial press that Sir James' name had been used as a decoy, and that his son's firm had received £1,000 for the use of it? A. I remember some newspaper comments upon his retiral, and I think he got some pretty rough handling in connection with it. I have heard rumours as to the £1,000, but of my own knowledge I can say nothing. The only item for brokerage in the Balance sheet is £27 5s. If any sum like £1,000 was paid, it would very likely be paid by the promoters, and if you are going to investigate their actions you will have a pretty tough job.

Q. Anyhow the retiral of Sir James was considered very damaging to the Company? A. Yes; it caused some applicants for shares to refuse to pay the £1 per share due on allotment, and to demand back their money paid on application. That was what first caused me to think there was something wrong, but unfortunately, my calls were paid by my agent in my absence.

Q. What became of Sir James Whitehead's shares? A. I was told by the secretary that he had been relieved of them by some of the other directors, but whether that was the truth or not I am unable to say.

Q. Did you ever hear that his shares had been transferred to one of his clerks? A. Before I would reply to that, Mr. Editor, I should like to get a perfectly clear idea of where this talk is leading to. From what I have seen of the attitude of the REVIEW, your object seems to uphold Canada as a field for investment, and in doing so, to expose, as you yourself has well put it, the present pernicious system of company promoting prevalent in London. Before I answer the question, may I ask if this is your sole motive in this interview?

THE EDITOR—Entirely so. There is no other motive. We have endeavored to show that the Corpora-

tion has been a series of blunders from first to last, and that its affairs have been grossly mismanaged, particularly by its representatives on your side of the water. Its failure, you know, must seriously affect the good name of the country.

MR. SHIELDS continuing — Well, I don't care whether Sir James got his shares transferred to a clerk or not. If he did and the Board sanctioned such a transfer, it is only another nail in the Board's coffin. But of what avail was it anyhow? It did not alter the fact that Sir James was responsible for the prospectus, nor did Mr. Sampson Lloyd's retiral relieve him from the same responsibility.

THE EDITOR—Of course, Mr. Shields, "you must know that since the date of Sando's notorious "green prospectus," the REVIEW has honestly endeavoured to show up the mistakes, and bad judgment of the promoters and management. It has been fully posted of the criticisms of the London press. We have here, too, from a friend on the other side, the circulars issued to the shareholders from time to time, notably those of Barff, Crawley, Duncan and Kemble, and other shareholders who took exception to the Board's action. (These circulars are printed in this issue of the REVIEW for the first time. See ante.)

Q. Did Sir James reply to any of the attacks made upon him? A. Not that I know of, but I was a good deal abroad and may have missed seeing any reply in the newspapers.

Q. He treated them with indifference? A. That is my impression.

Q. And the director's took no notice? A. These circulars you have are the only notices so far as I am aware.

Q. But surely these were very serious charges against men in the position of the directors, and especially against Sir James Whitehead—an ex-Lord Mayor of London? A. Well, you know as much about it as I do and can draw your own conclusions.

Q. What do you know about Sir George Baden Powell? A. That is a pretty comprehensive question. In connection with this company do you mean?

Q. Yes. A. He is nominally a director.

Q. Why do you say "nominally?" A. Because we were informed in London that he claimed to have nothing to do with the company. I was informed no later than yesterday that when he was last in Ottawa he declined to receive the manager of the company officially and said he would have to drop all that sort of thing now.

Q. Perhaps the waters were getting a little too dirty for his fishing. A. You can put what construction you please upon it.

Q. Has Sir George paid his calls. A. That I do not know.

Q. The Balance sheet shows that "calls in arrear" amount to £2,400. Do you know who these represent? A. I do not. I should say that a good many of them are those who are now fighting the company.

THE TREMENDOUS ARRAY OF FOUNDERS A BOGEY.

Q. A great deal, Mr. Shields, has been made of what you yourself call the "tremendous array of founders." Is it not a fact that a great many of that gentry did not have any direct interest in the stock of the Company, while others were merely nominal? A. I consider all of them merely nominal. You will find precious few of them with more than one founder's share and fifty ordinary shares, which involves a liability of £510.

Q. Would you ascribe the founders' indifference to this small liability, to the serious charges made against the management or are there other influences? A. I would ascribe it chiefly to the small liability. What do most of these founders care for a loss of £510? I think, however, they are in honour bound to assist the poorer shareholders, who invested on the strength of their names, to get back their money, and also to punish those who are responsible for all the loss. I know I cannot afford to lose as much as six dukes, which is about my position.

Q. It is currently reported in Canada that some of the more prominent politicians and Canadian founders have not yet paid their calls. Do you happen to know anything about this? A. Not particularly, but I should not be surprised. Recent events in Canada have shown that political morality in some quarters is conspicuous by its absence.

SANDO'S COMMISSIONS AND CHIMERAS.

Q. You may have heard, I dare say, Mr. Shields, charges of "palm greasing" by gentlemen who occupy positions on the Board. Have you heard of anything of that kind? A. I shall reply to that question in the Scotch fashion, by asking another. Do you think it necessary to ask me such a question with Sando's evidence in "Wills vs. Stewart," in the last number of your paper?

Q. Let us see as to that. Sando acknowledges to have received £11,000 as commission on the sale of the Stewart properties, and a further sum of £9,000 for realizing the securities which formed part payment to Stewart? A. Exactly. Just a clean half of what the Company paid for the property. And this is the man who has been made managing director of the Company, and of whom Lord Stalbridge says "he carried out his contract with the Corporation to the satisfaction of the Board, and has always shown his willingness to assist in making the Corporation a success," and further: "We have considered him the proper person to assist in the management of the Corporation's affairs."

THE EDITOR—It certainly does strike one as being rather a peculiar qualification. Why was Sando elected to the Board? A. You know as much about it as I do. The fact is simply stated in that circular of 4th July, 1892.

Q. Why, one would be justified in believing your Board either a parcel of fools or knaves. A. You can take your choice. I have my own opinion.

Q. Which is? A. I suppose you have heard the saying attributed, I think, to Carlyle, that "mankind is made up of 'fules and knaves—maistly fules.'" Maybe you can guess my opinion of the Board from that.

Q. But the "boodle" which Sando acknowledges to have got was only in connection with the £40,000 paid for the Stewart properties. What about the Colby and Abbott deals, and others, for which the remaining £58,863 was paid? Is it known how much Sando pocketed for them? A. Oh, yes! and perhaps it will not be long before all the dirty linen connected with these cases will be washed in court.

Q. It is currently reported here that he netted a proportionate sum by the sale of these properties to the Corporation, which would make the total of his boodle about £50,000. A. I shouldn't wonder.

Q. What do you know of the North Star mine transaction? A. I know that if the shareholders do not take immediate steps to get the control of affairs out of the hands of the present board the consequences will be a burst up. In connection with the super-phosphate scheme I am told they are actually anxious to sign a contract for a long term of years for sulphuric acid at $7.50 per ton, after their own engineer reporting that they could get all they want at a very much lower figure. At the last general meeting the report of this same engineer was suppressed and his statement of the amount of ore on the dumps at the mines was "cooked" to give it the appearance of showing 3,000 tons of saleable ore, whereas there was only between 600 and 700 tons.

Q. What do you think, after your investigations on the spot, of Sando's great railway scheme, of which Lord Stalbridge says: "The value of which can hardly be overestimated." A. If Sando had to live on the earnings of that railway he would not find it quite such good living as company promoting. Why a railway from Labrador to the North Pole would have as much chance of earning a dividend as would a line of stage coaches. The natural source to look for railway facilities in that district is the Canadian Pacific Railway, who could easily and cheaply extend their Buckingham branch; and the fact that they do not consider any extension necessary at present, is sufficient condemnation of Sando's wild cat scheme.

Q. But you know Sando talks of an annual output from the Corporation properties of 80,000 to 100,000 tons? A. If Sando could show a reasonable prospect of a fraction of that output he would very soon find a railway there; but unless the output from the whole district increases enormously the present system of river navigation can transport the whole of it without any trouble.

Q. To whom is the blame attributed for the unfortunate position of affairs? Are the Canadians blamed much? A. I don't think so, unless for being in collusion with the promoters. I don't think people grudge seeing a man getting the best price he can for his property, so long as everything is square and above board, but when sales are effected by the methods revealed by Sando in court, then it is apt to be designated fraud and usually gets punished.

Q. Then you think it not improbable that Sando, Mallaby-Deeley, Davidson and the rest may be called to a stern reckoning. A. Yes; and the original Board as well.

SANDO'S PIETY.

Q. Do you know Sando personally? A. No; I saw him the other day in Montreal, and a friend wanted to introduce him to me, but I declined. I was told that a conspicuous portion of his luggage is a large Bible, and that he combines street preaching with company promoting and other pious labours.

Q. You don't believe in such combinations? A. I do not. It goes down with some people, however.

Q. It has evidently gone down with the Board of the General Phosphate Corporation. A. Yes. I suppose you occasionally see Labouchere's *Truth*. Well, let me recommend you to invite his co-operation whenever you wish to expose a fraud. He has a particularly keen scent for rogues and imposters, and I should say that this particular case would be one after his own heart.

THE PROSPECTUS FALSE AND MISLEADING.

Q. You have stated that the directors will probably be held liable for the loss; the prospectus must first be shown to contain false and misleading statements, must it not? A. There is no difficulty in showing that; it simply bristles with them.

Q. Have you heard that Mallaby-Deeley boasts that he worded that prospectus so that no shareholder could ever get a hold on the Board? A. Oh, yes! but Mallaby-Deeley, or whatever his name is, will very soon find that he has not been so smart as he imagines.

Q. Do you mind mentioning any of the misleading statements? A. Not at all. Take that paragraph about Sir Wm. E. Logan's report. It reads in the copy I have in my hands, published in the London *Globe*, as follows: "Sir William E. Logan, LL.D., F.G.S., director of the Geological Survey of Canada, in one of his reports to the Canadian Government states: 'Of late years,' etc., etc. Now you know as well as I do that Sir William was not director of the Geological Survey when that prospectus was issued, and for the very sufficient reason that he had been dead a great many years. I call that as false a statement as could be made, besides being clearly intended to mislead. Then they quote from the report, beginning: "Of late years;" which is also clearly intended to convey the impression that the years referred to were, say 1889, 1888, 1887, whereas they were in point of fact the years prior to his death, which occurred, if I remember rightly, in 1875. Then in that article of yours of May last, which Mr. Crawley circulated among the shareholders, you show how misleading the list of experts given in the prospectus is, but I think you have overlooked a most important point. If you look at the preceding paragraph you will see that the directors after stating that they were entirely unfettered, say they "will "be enabled to purchase phosphate properties on the best "possible terms. *This they will only do on the advice of "first-class experts, selected by the directors.*" Now, there is ample evidence in London to prove that statement false and misleading, but in addition to that, Sando's evidence in "Wills vs. Stewart," is most damning against the directors as showing that unless they considered Sando himself an expert (which he admits he is not, and which, I don't think anybody would dream of calling him), the properties were bought without the advice of any expert whatever. Listen to what Wills' counsel says about the Stewart properties: "The "transaction between Stewart and Sando was in "reality a fraud upon the General Phosphate "Corporation, because the evidence showed that "that Corporation was ignorant of the fact that it was "paying £40,000 for property which its agent was pur- "chasing for it for £29,000, and that the sale was made "directly from Stewart to Sando in order to effect this "fraud." Why if an honest disinterested expert had been employed, the Corporation could have acquired for the £15,000 that its issue of debentures cost, much more valuable properties than those it paid £98,000 for. Don't you, as being familiar with this whole district, consider that it could?

Q. Decidedly. Well, I don't think I need ask you to say anything further regarding the prospectus. Have the directors not yet realized what sort of character Sando is? A. Apparently not. You see Lord Stalbridge's circular of July 4th.

EDITOR—Well, Mr. Shield's I have to thank you for speaking so freely and I hope for your sake and for the sake of the other victims of this fraud that the perpetrators will be punished and that you will get your money back. A. Thank you, I have no fear but that we shall. You may say further if you like, that after a most careful investigation into the phosphate industry of Canada, I am of opinion that the General Phosphate Corporation scheme was a good one—not Sando's idea of that scheme—but the scheme described in the prospectus, and if that prospectus appeared to-day I would, knowing what I now know of phosphates subscribe without any hesitation, and I am satisfied that had the company been managed as the prospectus led the shareholders to believe it would be the results would have been perfectly satisfactory in spite of the Florida "boom," depressed trade, or anything else. In that case also, Canada, instead of being the plaything of unscrupulous promoters and guinea pigs, would have been materially benefitted and enriched.

Nova Scotia Coal Royalty.

The Government has an innings—Full Text of Attorney-General Longley's Reply to the Contentions of the Petitioners for Disallowance.

HALIFAX, Sept. 28, 1892.

DEAR SIR,—I have carefully considered the Memorial signed by Henry S. Poole and others, which your Deputy has under your directions forwarded to me with an intimation that you would be pleased to have any observations I might see fit to make in reference thereto.

In the first place, it is hardly necessary that I should point out that the management of the mines under the British North America Act is vested exclusively in the Provincial Legislature, and that therefore they have the sole and exclusive right to legislate in reference thereto as long as that legislation does not trench in any way upon the laws which the Parliament of Canada is competent to make. As the Act complained of in this instance is an Act relating solely to the management and control of the mineral interests of Nova Scotia, and is simply a compilation of the Acts already upon the Statute Books, with a few amendments, I certainly am unable to comprehend any reason why a serious proposal should be made to His Excellency the Governor-General to interfere with its operation.

Second: The particular clauses to which objection is made are those relating to the royalties upon coal. It will be scarcely necessary for me to remind you that the royalties upon coal in Nova Scotia constitute the largest source of Provincial revenue outside of the Federal allowance, and therefore any interference on the part of the Federal authorities with the prerogative to obtain revenue from this source would be such a direct and vital interference with the rights of the Province as to make government practically impossible. The whole financial policy of a Province might be based upon the administration of its chief source of revenue, and any attempt to abridge this right might lead to Provincial bankruptcy. The right to raise revenue by direct taxation, of which the mining royalties are a species, is an undoubted right and one which would involve the gravest consequences if interfered with in the slightest degree.

Third: One of the objections is that the Act is made retroactive in its operation. This is very easily explained. The Government of Nova Scotia determined upon the policy of readjusting the coal royalties in the early part of February, and sent notices to that effect in writing to all the coal owners in Nova Scotia. This was a distinct intimation to them that legislation would be introduced

by the Government at the ensuing session fixing the royalty on all coal removed from the mine at ten cents per ton royalty, and they were notified to make their arrangements for the season's work accordingly. In the Act, Chapter 3, of the Acts of 1892, you will find that by Sections 2, 3 and 4, provision is made that in all cases where contracts, either written or of a verbal character, had been entered into prior to the 23rd of February, which was ten days after the notice had been mailed, that the royalty should be paid under the old basis. I think that this removes the suspicion of unfair dealing on the part of the Government with any of the coal owners.

Fourth: The Government might fairly take the ground in relation to this application that—the legislation complained of being strictly and unquestionably within the legislative rights—it is not called upon to explain, justify or defend the provisions of its measure. Independent legislative authority I interpret to mean the right to legislate without restriction within the compass of its legislative powers. This includes the right to introduce legislation that some people may think wrong. In fact, no Act of Parliament has ever yet been passed that has not met with opposition and adverse criticism from some, and most legislation is denounced by half the population. But I do not think the principle could be entertained for a moment, that this constitutes a reason why any party should interfere to override the rights and powers which the constitution of the country has vested in any legislative body.

Fifth: Nevertheless as the Memorial alleges breach of faith and an excess of legislative authority, I am quite content to submit for the consideration of His Excellency the Governor General an answer to all these imputations, which I do not hesitate to say are without a shadow of foundation in any sense whatever. The legislation in relation to coal royalties, I maintain, are not only within the legislative authority of the Province, but are entirely in accordance with what is right, just and equitable, and do not even come within the possibility of a suspicion of breach of faith. When prior to 1886 the question of renewals was being considered by the Government during the meeting of the Legislature in 1885, representatives of the coal owners from all parts of the Province waited upon the Government and discussed the whole question. It was intimated then, that the fact that the Government had a right after 1886 to alter and revise the rate of royalty would likely be an injury to the coal mining industry, and might prevent capital from seeking investment, whereupon the Government at that time distinctly offered to introduce an Act to authorize the Government to enter into a contract with the leaseholders to the effect that the royalty should not be increased beyond a certain maximum figure which should be agreed upon. This the coal owners after some consideration declined, and Section 4, of Chapter 4, of the Acts of 1885, was put in deliberately by the Government for the object of notifying clearly the coal owners that this increase would take place whenever in the discretion of the Legislature it was deemed advisable. That you may have a full understanding of the position which the Government assumed in this matter, I append a copy of a report made by me for the use of the Government January 12, 1892, and also the opinion of Mr. W. B. Ross, Q. C., which I specially obtained. Although quite satisfied in my own mind that the Government had the most absolute legal and moral right to inaugurate this legislation, I thought it desirable to obtain the opinion of independent counsel upon the subject, and I submitted to Mr. Ross these two propositions for an answer: First: Has the legislature the right to increase or diminish the coal royalty after 1886? Second: Would an increase in the coal royalties in 1892 during the currency of existing leases constitute a breach of faith with the lessees, or affect the honor or integrity of the Government or the Legislature? Mr. Ross' opinion on these points is appended.

I have the honor to be,
(Sgd.) J. W. LONGLEY,
Atty.-Genl. Nova Scotia.

The Honorable
Sir J. S. D. Thompson,
Minister of Justice.

RE COAL MINES.

The first grants issued by the Government of Nova Scotia after it became established as a Province reserved nothing in the way of minerals but gold, silver and other precious metals. Later on, about the year 1764, coal was expressely reserved in the old grants and still later, about the year 1808, iron and other minerals were likewise reserved in the grants. For all practical purposes it may be said that the coal in all the mines in Nova Sootia has been reserved in grants issued in the localities where these coal formations are found, so that the right of the Government to impose rentals or royalties on the product of coal is universal.

On the 25th day of August, 1826, the Government of Nova Scotia by Letters Patent expressed to be made by His Majesty King George IV, certain mines and minerals in the Province of Nova Scotia were demised to H. R. H. Frederick Duke of York, for the term of sixty years at the rents and royalties therein mentioned, which rents I believe amounted to £3,000 a year. Subsequently an agreement was entered in, on the 12th day of September, 1826, whereby certain mines and minerals in this Province, which were not included in or were excepted out of the said Letters Patent, were demised to John Bridge and others who had received an assignment from the Duke of York of his interests in the lease from this Province. After a time the Government and parliament of Nova Scotia, became satisfied, from the development of the coal mining industries of this Province, that a great mistake had been made, and a great injustice done the Province in thus parting with its entire interests in valuable coal deposits for such a limited rental, and efforts began to be made in the legislature to have this improvident arrangement set aside. Negotiations of various kinds were entered into with unsatisfactory results, until in 1853 the Legislature of Nova Scotia passed an Act, the purport of which was that all leases ot coal mines that were not being effectively worked should be liable to forfeiture, under which it was proposed to re-acquire the title to all those portions of the coal areas of Nova Scotia that were not being actively and effectively worked by the General Mining Association of England, a body corporate which had acquired the rights of the Duke of York and the other patentees.

In 1857, however, a more direct attempt to get the matter settled was made, and two delegates, the Hon J. W. Johnson and A. G. Archibald were sent from this Province to England, to negotiate a basis of agreement between the Government and the General Mining Association, whereby a more satisfactory arrangement could be entered into. They came to an agreement which was in substance as follows:—

The General Mining Association were to have leases which should extend to August 15th, 1886, the period of time at which the original lease would expire, of three areas in the Island of Cape Breton, one in the County of Pictou and two in the County of Cumberland. Some of these areas embraced several square miles. They were to pay a royalty of 6d. currency per ton on all quantities up to 250,000 tons and 4d. per ton on all quantities over that.

It was also provided that the Province should not allow any other person to mine coal in Nova Scotia at a less royalty or on more favorable terms, and it was also covenanted that the Province should not, without the consent of the Association, impose an export duty on coal. All the other coal areas of Nova Scotia were by this agreement surrendered and transferred absolutely to the Province of Nova Scotia.

After this agreement was carried into effect the legislature provided that the same royalty should be imposed upon the lessees of other coal mines as were fixed as the maximum rate for the General Mining Association. I have no doubt that the Legislature of Nova Scotia would have had a right at any time prior to 1886 to have imposed a greater royalty than 6d. per ton upon coal mined at any other than the mines leased to the General Mining Association. But of course it would have been unfair and contrary to public policy to have done so.

The leases which were issued between 1858 and 1886, when all leases were to expire, have contained a condition that the Government reserved its right to alter or revise the royalty after 1886. When August 15th 1886 arrived, as I understand it, the Government of Nova Scotia were at liberty to take exactly the same course in respect to the coal mines of Nova Scotia. and in respect of coal royalties, as they were in a position to take prior to the lease of August 15th, 1826. The Legislature in 1885, made some provision in regard to a change in the amount and mode of reckoning the royalty. Hitherto the 6d. per ton had been imposed upon screened coal, and it was provided that in substitution for this a royalty of seven and one-half cents upon all coal mined should be imposed. The Act of 1885, also provided that all leases renewed in 1886 should contain a provision that the royalty might be increasd, diminished, or otherwise changed by the Legislature. This was a notice to all lessees in the Province that not only had the Province a right to absolute control in the amounts of royalties imposed, but that it was explicitly to be understood that it held itself at liberty to exercise this right whenever it chose. The leases were renewed in 1886, and contained this provision. I am told by the Department that some lessees preferred to take their renewal in the form of the original lease which contained the words "subject to the right of the Legislature to revise or amend the royalty after the year 1886." In my view, this form of lease in no degree limits or abridges the absolute and unrestricted power of the Legislature to fix whatever royalties it may see fit at this time.

I have, therefore, to advise that in my view there is no contract or legal obligation existing between any coal lessee and the Government of this Province which prevents the Government and Legislature from increasing, changing or diminishing, if it chooses, the royalty imposed for coal taken from the mines which belong to the Province.

J. W. LONGLEY,
Attorney-General.

JANUARY 12th, 1892.

[COPY.]

THE GOVERNMENT SUPPORTED BY THE OPINION OF MR. W. B. ROSS, Q.C.

HALIFAX, April 18, 1892.

DEAR SIR,—I have your letter of the 16th inst., in respect to the above matter and have to say in reply thereto:—

1. That the rights of lessees of coal mines must be determined by the Statutes of the Province of Nova Scotia and the leases made under them. This follows from the transactions between the Province of Nova Scotia and the assigns of the Duke of York and others, in 1857, and Chap. 1 of 1858, which gave effect, so far as this Province was concerned, to these transactions. I do not think it necessary to refer to these transactions, which are set out in the *Journal* of the House of Assembly for 1858, but will proceed to examine the leases made in 1858 and after, together with the Statutes of the Province, with the view only of determining the questions put to me.

2. The lease made to the General Mining Association in 1858, and to others then and since, up to Aug. 15, 1886, contained no covenant or provision for a renewal thereof. If then such lessees have any right of renewal, it must be by Statute. I am of opinion that the rights of all lessees where leases terminated in August, 1886, (and these included all leases then extant) are to be determined by Sec. 105, of Chap. 7, R. S., 5th series. I am not aware of any Statute passed between 1858 and 1886 that gave to any lessee of a coal mine a right to a renewal that would not be displaced by Chap. 7.

Under Section 105, of Chap. 7, I am of opinion that the Commissioner of Mines might have, in August, 1886, issued leases to the lessees therein named, containing "terms, conditions and covenants as contained in the original lease," except in so far as these might be inconsistent with any Statute then in force, including Chap. 7 itself. It must be borne in mind that the Legislature was by that Statute bestowing a privilege that these lessees had no right to demand, and was virtually saying: If you give notice as provided for, we will give you either (*a*) a renewal of your old lease on the terms and conditions therein contained, or (*b*) instead thereof we will give you a renewal with such terms as we may see fit to provide by this or any other Statute.

If a lessee obtained a lease under either one or the other of these alternatives, the Statute would be complied with and no complaint could be made by him. It is not the lessee who can say, I must have this or that as I choose. On the contrary, it is the Crown or Legislature who says, I will give you this or that—not both, but either one or the other, and when I have given you one of the two, there is an end of the matter. In other words, the Statute must be read from the standpoint of the owner of mines and not from that of the lessees. Putting it in another and more strictly correct way, Chap. 7, Sec. 105, is a direction to the Commissioner of Mines to do the one or the other. He has done one of the two, and therefore has complied with the Statute.

3. This clears the way for answering your questions. I understand that in some of the leases granted after 1886, the following clause will be found: "Provided also that the Legislature shall be at liberty to revise and alter the royalty imposed by these presents in or after the year 1886 as they may think fit," and in others it will not. In my opinion it makes no difference whether they do or not. As I have already said, the Commissioner would be bound by the Statutes in existence in August, 1886, when these leases terminated.

In 1886, I am instructed that leases were granted containing the clause provided for in Chap. 4, of 1885, Sec. 4: "All leases of coal mines issued after the passing of this Act, shall contain a provision that the royalties may be increased, diminished or otherwise changed by the Legislature," and that several leases were granted containing the proviso on the same subject which the leases referred to above, granted before 1886, contained.

I am of opinion that these provisions mean exactly the same thing, viz: We reserve the right in 1886, or at any time after, to alter the royalty as we see fit. The word "alter" covers "increase" as well as "decrease." It means to "change." It would be difficult to make the proviso wider than "to change as you please."

Let us suppose an ordinary lease reserving a quarterly rent of $100, with a proviso that the landlord might alter the rent at any time after a particular year, as he saw fit. It cannot be argued that he would not have a perfect right to make the rent such sum as he chose at any time after the time named. The whole case turns on Sec. 105, of Chap. 7, R. S. If my view of this is correct, there is nothing to argue.

I have to say to your first question "Yes," and to the second "No." Yours truly,

The Attorney-General, (Sd.) W. B. ROSS.
Provincial Building.

Stopping Back Water by Brick Dams.—An account is given by Mr. J. Niven of the brick dams constructed at the Mirfield Moor pit, for stopping back a heavy feeder of water. During the sinking of the pit a large amount of water came from the river through an open-jointed rock, and had to be tubbed out. Coal was met at a depth of 457 feet, or 110 feet below the Ordnance datum; and on driving towards the river, two up-throw faults raised the coal 70 feet. These were cut through by a stone drift rising 6 inches to the yard, and the workings continued to a distance of 300 yards from the pit-bottom. It was then found that a very large amount of water was coming through a stratum of 2 inches of soft dirt below the coal, and flowing down to the pit, where it had to be pumped from a depth of 200 yards. Brick dams were accordingly put both in the intake and return drifts. The dam in the intake was 10½ feet wide by 7½ feet high, and six courses of bricks in thickness with 1 inch of cement between each course. The dam in the return was somewhat smaller. The floor, roof and sides, were cut back 18 inches, and a six feet length of arching was placed on the outbye side of the intake dam as the roof was weak. In ten days the pressure rose to 108 pounds per square inch, but the dams have remained tight. The cost of the two dams was 70 pounds sterling. (Transactions of the Federated Institution of Mining Engineers, vol. 3, 132-138.)

On the Distribution of Coal in the Dominion of Canada.*

When nature deposited coal upon the continent of North America, she distributed the mineral regardless of the territorial distribution of rival nations. We are thus presented with the anomaly of an Ontario supplied with fuel from Tennessee and certain of the border states of the American Union in a curious juxtaposition to the fuel of Canada, with which the American mineral can scarcely hope to compete. Going westward from the sea, the first coal encountered is the immense deposit generally known as the coalfields of Great Britain, where some 200,000,000 tons lie dormant. This district is the natural basin and source of supply for the New England States, which possess a magnificent market for 60,000,000 tons per annum, large portions of Nova Scotia and the neighboring province of New Brunswick, and practically the whole of the great Catholic province of Quebec, but owing to political restrictions the two latter form the most important sources of demand. Crossing the island we next encounter the fringe of that which appears to be a submerged coalfield, resting in the bed of the St. Lawrence, the Rocks of Prince Edward Island and the Gulf shores of New Brunswick, where we discover really valuable deposits of coal, presumably of a quality equal to that from the Sydney seams themselves. The province of New Brunswick has not attained to great importance as a mining region, although a very great part of its area is underlain by the coal measures, and many of the economic metals, &c., are known to exist. The coal formation occupies a triangular area, the base of which rests upon the Gulf of St. Lawrence, extending from the town of Bathurst on the north to the frontier of Nova Scotia on the east, the apex repressing upon Oronecto Lake, the north-western margin trending thence to Bathurst, the south-eastern approaching the shores of the Bay of Fundy, containing seams varying in thickness from 20 in. to 4 ft. of good clear coal, reposing at inconsiderable depths and favourably situate for market. The entire country is, however, so undeveloped with respect to settlement, industries, &c., and so proximate to the mines of Nova Scotia and Cape Breton, that very little actual exploitation of the productive measures has taken place. Thence into the North-West Territories, Canadian territory is devoid of coal, although inclusive, in the wide interval, of the densely-peopled Ontario, the home of industries, factories, mills, &c., of every description, and famous in its more northern portions as one of the richest metalliferous regions of the continent. The North-West Territories of Canada are in parts richly carboniferous, and so abundantly supplied with majestic streams that an equitable distribution of fuels among the cities and towns of the fertile prairies is readily ensured. Furthermore, as remarked at the outset, the border states of the American Union cannot ignore the coal of the north, and I venture to prophesy that, at no very distant period, Alberta or Saskatchewan coal will be as familiar as "Hastings Hartley" or "Wallsend" is to the average Londoner. The intervals between the territories and the Pacific provinces of British Columbia is filled by the Rocky Mountains, themselves, in parts, richly carboniferous, and the adjoining low lands are amply supplied with fuel from the coalfields of Vancouver and Comox. Notwithstanding her coal deposits, Canada still imports more coal than she exports. During the fiscal year ending 30th June 1891, some 1,599,000 tons of bituminous and some 1,399,067 tons of anthracite coal were entered for home consumption in the Dominion, in spite of a prohibitive tariff of 2s. 6d. per ton on the bituminous article, from the following countries :—

Bituminous Coal.	Tons.
Great Britain	36,087
Australia	5
St. Pierre	10
United States	1,562,753

Distributed thus :—

Ontario	1,510,411
Quebec	72,880
Nova Scotia	28
New Brunswick	4,491
Manitoba	9,788
British Columbia	1,098
North-West Territories	159

Anthraeite Coal.	Tons.
United States	1,309,067

Distributed thus :—

Ontario	931,463
Quebec	375,615
Nova Scotia	33,146
New Brunswick	50,375
Manitoba	6,224
British Columbia	1
Prince Edward Island	2,243

Coke.	Tons.
Great Britain	648
United States	37,885

Distributed thus :—

Ontario	32,375
Quebec	4,903
New Brunswick	8
Manitoba	215
British Columbia	1,032

*Special Correspondence of the *Collery Guardian.*

During that period the Dominion exported as the produce of her coal mines 833,684 tons of bituminous coal from following provinces :—

	Tons.
Nova Scotia	183,540
New Brunswick	37
British Columbia	647,508
North-West Territories	2,232
Ontario (coal stores)	368

The foregoing was distributed over the following markets :—

Great Britain	26,000
British Guiana	1,191
British West Indies	5,421
Australia	2,104
Hong Kong	2,410
Newfoundland	73,397
France	725
Germany	760
Japan	1,166
Mexico	4,047
St. Pierre	7,226
Sandwich Islands	12,266
Spanish West Indies	4,326
United States	692,705

Coke to the United States from New Brunswick, 7 tons.

As fireclay forms with us in Britain an important item in the profitable working of some collieries, I append a list of imports and exports, from which we observe that the Canadian beds, which often form the floors of the coal seams, are largely neglected—neglected, I may add, to the detriment of general prosperity in the mining regions, where surplus labor, instead of being actively engaged in such remunerative pursuits as the clay would afford, gradually drains off into the United States, or the more westerly portions of the Dominion. I have never hesitated to deplore to the mining populace this unnecessary neglect of golden opportunities and can certainly affirm that the miners themselves are alive to what might be accomplished in this direction. The secret of the whole matter, however, is the protection afforded to the coal operators by a prohibitive tariff upon foreign coal, a precaution requisite for the prosperity of the native industry at its inception, but quite unnecessary when such has attained maturity, inasmuch as it has created a monopoly to the advantage of the few, who in a rapid and considerable increase of wealth, remain indifferent to other sources of wealth, which form the basis of the general prosperity of so many.

During the fiscal year ending June 30, 1891, the Dominion imported $24,878 worth of unmanufactured fireclay from the following countries in the following proportions of value :—

Great Britain	say £1,200
Germany	" 100
United States	" 3,680

Distributed thus in proportion of value :—

Ontario	say £1,200
Quebec	" 3,200
Nova Scotia	" 140
New Brunswick	" 200
Manitoba	" 5
British Columbia	" 220
Prince Edward Island	" 8

And exported none whatever. It should be added that these importations of clay are free of duty.

A persual of the foregoing statistics reveals that Canada draws large supplies of fuel and fireclay from the United States. In the instance of anthracite, this is perhaps excusable, for the native deposits are perhaps too remote for extensive exploitations at present, but in respect of bituminous coals and clays, manufactured or crude, I venture to state that Canada is not sufficiently in earnest. No country possesses a more superior system of waterways. From the Straits of Belle Isle to the head of Lake Superior—a distance of 2,384 miles, 72 of which are canals exclusive of the great industrial centres of Ontario—are vast aqueous highways, tempting to enterprise in the inter-colonial exportation of coal, and little doubt can be entertained that if the Canadian operators would combine in an earnest effort to drive off their rivals, the native industries would experience renewed prosperity, and in the inception of industries not now indigenous to the Dominion important classes of the community would materially improve their condition.

MINING NOTES.

[From our Own Correspondents.]

Nova Scotia.

Caribou District.

Later development on the new strike found in the Lake lode on the property of the Truro Gold Mining Co., show a defined pay chute of very rich quartz, estimated at 50 ounces to the ton. This chute averages ten to twelve inches in thickness, and its breadth has not yet been determined. East and west of the chute the quartz is averaging better than in the upper workings.

The management have stopped underground work temporarily until the old boiler has been reset, and until a new engine can be placed.

Darr's Hill.

The last month's work on the lode found in the North Cross-cut has shown the quartz to be gaining in richness. The quartz from the old vein maintains its usual character and grade.

Country Harbor.

Work on the Copeland mine continues uninterruptedly with the usual grade of ore. The deepest workings are yet above the 100 feet level, and the supply of milling ore in sight is very large.

The Country Harbor Gold Mining Co. is about to resume work.

Goldenville.

Late advices from this district report work slack. The operations on the "Alexandria" are to be suspended for the winter, and it is not probable that much, if any, quartz will be raised during the balance of the year.

Malaga.

Times in this once "booming" district were becoming dull, until recently. The Boston Gold Mining Co. are, however, meeting with encouraging results in their development work.

The output of the Molega Co. has been somewhat reduced the last few months owing to the diminished output from the Rabbit lode, but rumor says that Mr. Wade, the superintendent, has recently opened a new vein which promises well on development.

The plant of the Parker-Douglas Co. is to be sold in December.

Montagu.

The Salisbury Co. is erecting a five stamp mill, made from what is known as the "Nisseu" patterns. The Windsor Foundry will supply the iron work, and Mr. Nisseu himself is superintending the erection. None of the machinery has yet been delivered and the mill will not be in commission this year.

This experiment of the Salisbury Co., in trying a new type of mortar will be watched with interest, as the old type of Nisseu mortar, used in Killag, was not an unequivocal success. It is understood, however, that Mr. Nisseu has modified his designs.

Several changes have been made in the *personnel* of the staff at the mines of "the Nova Scotia Gold Mines, Limited," and "the Symons-Kaye Syndicate, Limited." Mr. Lucius J. Boyd has been transferred to the Symons-Kaye property, and with him has gone Mr. McQuarrie. Mr. Thomas, a young Cornish engineer, has been put in charge of the New Albion or Annand mine, vice Mr. Boyd. Mr. Thomas' previous experience has not embraced gold mining in any of its branches, being chiefly in tin and copper.

Mr. Woodhouse has sailed for England to endeavor to promote a sale there.

Oldham.

The Napier Mining Co., Limited, has put in a small steam plant for pumping and hoisting, and prospecting work will be carried on on the 100ft. level all winter.

The Rhode Island Co'.s shaft is going down slowly, and no improvement in the character of the lode is discernible. This company has been operating for eleven months, and in that time have met with no quartz that it has thought good enough to warrant milling.

Waverley..

On the 14th November the miners working in the East Waverley Tunnel blew off a slice of quartz exposing the "Barrel Lode," which has been the objective point of the tunnel. At date of writing no gold had been seen, as the lode had only been stripped and not taken down. The result of this work will probably be a substantial addition to the list of gold producers for 1893.

Rumors have been circulated that the lessee of the LakeView property would resume mining work this winter, but this rumour is discredited by parties acquainted with the property.

Quebec.

Gatineau District.

The Foley lot in the 11th range of Hull has shut down indefinitely, owing to injunction issued by the Lake Girard Mica Syndicate. About 25 tons of mica were taken out in a short time and the shows look well in the three pits opened. Two guardians are holding the mine down day and night in case the other fellows may carry it off.

The Nellie and Blanche mine is turning out a good quantity of large crystals, 45 men and 4 teams being employed. The Lake Girard Mine is being worked as usual, about 50 hands and 6 teams are employed.

The Horse Shoe Mine is turning out about 25 tons "culled" mica monthly, 42 men and 3 team being kept steadily at work since the spring.

The Lake Girard Mica System are now operating six mines on the Gatineau and one in Templeton, and in their cutting house in Ottawa employ 45 hands.

Templeton District.

Judge Dugas, Mica property on the 18th Range, has shut down for the winter. The output of mica, about 20 tons, has been shipped to Montreal.

The owners of the Lake Girard Mica Syndicate are erecting buildings on their property lately purchased from Mr. Hutchins, the Murphy Estate. About 25 men are employed.

The Blackburn mines are still working a small gang of 25 hands in the old pit.

The Templeton Asbestus Company are working 8 or 9 men.

L. K. Lee is still working 5 men on Lot 4 in the 9th Range. The deposits of mica are very large, but the crystals are considerably cut up and contorted.

Geo. Wallingford has disposed of his half interest in his lease of the Stevenson-Hotchkiss lot in the 8th Range for $1,300. The lease has only 6 months to run, and owing to Stevenson's injunction the property cannot be worked for a year at least.

Beauce District.

Mr. E. B. Haycock, has a force of some fifteen men opening out his gold property on the Du Loup. Besides working the alluvial gravels a tunnel is being driven to tap some promising quartz lodes exposed on the bank of the river. The small prospecting mill and concentrator from the works of Fraser & Chalmers, Chicago, has arrived and will soon be in working order.

Black Lake District.

The Glasgow and Montreal Asbestos Company has shut down for the winter. It is not unlikely that a similar course will be adopted by the Anglo-Canadian and United Companies. Messrs. King Bros., will, however, continue the development on their property. Manager Evans (King Bros.) is driving a tunnel at present which is expected to give a good workable area of asbestos ground.

It is reported that Mr. L. A. Keein, the popular manager of the American Asbestos Company will shortly leave for England to attend the annual meeting of his company.

Ontario.

Hastings District.

Under the management of Mr. G. McDougall, the Crescent Gold Mining Company of Marmora, has a force of between 30 and 40 men employed. "A" shaft is down 92 feet; "B" 45 feet; and "C" 81 feet. The 10 stamp mill is reported to be running on good pay quartz.

Work is being rapidly pushed forward on the property of the Belmont Gold Company, recently acquired by Mr. Middleton Crawford, of Toronto. In a letter under date of 10th we are advised: "Mr. Crawford took over the property on the 7th October. On the 11th he broke ground for the foundation of his mill; in fourteen days from that date he had his boiler and engine in place and steam up, and just four weeks from date of commencement of mill, he had one Crawford mill in operation working on ore. It is generally conceded that this breaks the record for Ontario and it is especially commendable, when it is considered that at the time of purchase he had not one piece of machinery purchased. He got it all from Toronto and elsewhere, and to-day has one of the handiest and best equipped mills in the Dominion capable of treating at a low estimate, 30 tons of ore per day. The main shaft is down 115 feet and the ore at bottom is rich carrying a large percentage of sulphurets. Work has been started on other portions of the property with very gratifying prospects and the probability is that this property will prove one of the best paying in the country."

Sudbury.

The smelter at the Copper Cliff mine has been closed down temporarily for repairs. The steel water-jacket smelters used at most of the mines here generally need more or less patching up after being in operation from six to twelve months, and in this way they are made to last about two years. There is no other kind of furnace of the same cost that can do as much work.

The monster rock-house at the Stobie mine is nearly completed. It is an unusually fine building for this purpose, and reflects a great deal of credit on Mr. Ritchie (not the father of nickel mining here, but a builder of the same name), who planned and framed it. The company in evidently preparing for more extensive mining operations in the future.

At the Davis mine about twenty men are employed in putting up a shaft-house and an engine house. It is expected that the machinery will be set up by the middle of December, when the work of sinking the main test shaft to a depth of 200 feet will be carried on through the winter by power drilling, A good wagon road has been made from the property to the Blezard Mine.

Down the branch, the Worthington mine has the unfinished roast heap from last year when work was suspended, almost ready to be ignited, and after that the ore will be shipped to the Blezard mine in its raw state. The Travers mine is getting into good working shape. The sanitary arrangements at this mine are much better than at any of the other mines on the Range. The boarding houses and other dwellings are built on a beautiful side hill some distance from the mine, with natural drainage and an abundant supply of good water. There is altogether too much typhoid and other filthy diseases at some of the mines here.

Sault Ste. Marie District.

The Ophir Gold Mine, situated about 15 miles back from Bruce Mines, on the Algoma branch of the C.P.R., has been purchased by Duluth, Min., capitalists, who are at present employing ten or fifteen men in opening up the mine and have also some thirty-five or forty men putting up buildings for use of men and staff.

British Columbia.

West Kootenay.

Mr. F. A. Boehlofsky, who has just returned from the Kootenay county, says that he thinks it is one of the best and richest mining districts on the continent. The most curious thing to Mr. Boehlofsky is that people do not believe how rich the country is. Of course, those who are there are compelled to believe it, seeing the richness of the land for themselves. The growth of Kaslo keeps on, and next spring times will be good and business brisk. Nelson, the Lardeau and the Slocan country will also experience a busy time. The richest mines so far have been found in the Slocan and Lardeau countries, which are directly tributary to Kaslo City.

The Kootenay and Columbia Prospecting and Mining Co. are in receipt of the smelter returns on their sample parcels of ore from the Wellington mine, near Kaslo, B.C. The following are the results as received from the United Smelting and Refining Co. Smelter, Montana:—

No. 1—2,989 lbs. Ore.

Lead, per cwt.,	22.5, value per ton..	$ 15.59
Silver, per ounce,	347. 95%.....	280.20
Gold, "	.11.....	2.09
Total value per ton		$297.88
Smelting costs.....	$22.00	
Freight.....	14.95	
		36.95
		$260.93

Net proceeds, 2989 lbs. = $397.35

No. 2, 2,053 lbs. Ore.

Lead, per cwt.,	63.3, value per ton..	$ 43.87
Silver, per ounce,	246.2.....	198.80
		$242.67
Smelting costs.....	$ 23.50	
Freight.....	9.33	
		32.83
		$209.84

Net proceeds, $215.65.

No. 3, 3708 lbs. Ore.

Lead, per cwt.	60.2, value per ton..	$ 41.72
Silver, per ounce,	242.6..	195.90
		$237.62
Smelting costs.....		23.00
		$214.62
Less freight.....		16.85
		$197.77

Net proceeds, $381.05.

Settlement based on New York quotations of silver.....	85.
lead.....	3.85

A shipment of a similar quantity of ore to smelter at Tacoma has not yet been reported on. The owners report themselves satisfied with their investment. A Diamond drill and sectional boiler for same has been shipped with the object of testing the claim at greater depth.

Capt. R. C. Adams, of the Anglo-Canadian Phosphate Company, has returned to Montreal after a two months' visit to the mining camps of the Kootenay where he and other capitalists have made investments during the summer. Referring to recent discoveries in the Slocan Capt. Adams says: A number of claims had been opened up this season and transport was made by pack trains to Arrow lake, 40 miles distant. The average assay was 150 ounces of silver ore to the ton, although they get all the way from 5,000 to 6,000 ounces from single specimens. He had brought home average samples which had realized 475 ounces, while single samples had produced at the rate of 1275 ounces to the ton. Capt. Adams says that although the mining industry is but in its infancy in British Columbia, the possibilities of the future are simply boundless.

"The Kootenay Lake Reduction Company have their works located on Pilot Bay, which is really the centre of the district. There is a splendid wharfage and the most favorable surroundings. There are 900 feet of wharves in connection with the smelter, and the company have now erected a nine-roomed office building containing fire proof vaults and an assay office, 25x50, with a wing 25x25. These are in brick and iron, and are very substantial. There are also a warehouse, 35x65 feet, a blacksmith shop, 24x40 feet, a carpenter shop, 24x50 feet, two stories; a boiler house, 48x50 feet, and the smelter building, 60x98 feet. The samplihg works are 98x128 feet, and the calcining furnaces are located in a building 98x170 feet. The boarding house is three stories and a basement, and will accommodate about 100 men; everything about it is in good shape. There is also now in process of erection a refinery, which will be 120x245 feet. This will contain all the most improved equipment. The company will make all its brick, having for that purpose three drying houses, 36x50 feet each. The smelter will have room for three 100 ton stacks, and though but one will be built to commence with, everything is so arranged that the capacity can be increased with but little trouble when occasion demands.

East Kootenay.

The Coal Hill Kamloops Mineral and Mining Company, limited, has begun mining coal near Mr. Guerin's ranch, 2½ miles south of this town, under the superintendency of Major Vaughan. The drift of the mine is in about 110 feet and the coal has vastly improved and the quantity increased. A load of it is being burned in the Grand Pacific Hotel stoves.

Mr. Brackman, of the firm of Brackman & Kerr, has just returned from a trip into the East Kootenay district. The visit was to the Thunder Hill property. Mr. Brackman was asked regarding the general outlook in the region he has just been through. "The prospects are good," said he, "though just at present matters are slowing down for the winter. The work on the Thunder Hill is still going on, but the machinery will not be in place for some time. This is owing to the fact that the river has lowered to such an extent that vessels no longer land their freight at the mine. This has caused the different parts to be left at points along the river, and it will be necessary to wait until the snow falls and then bring the material on sledges.

"There has been put up a building 35x70 feet in which the men can continue work all winter. The new mill will have a capacity of 50 tons per day, and is so arranged that this can be doubled at any time and with but little additional cost. It will be some time in the spring before the mill is in shape to receive ore. When it is the entire country around Thunder Hill will go ahead rapidly. There are great numbers of good low grade properties in this section. These cannot be worked to advantage, but when their product can be concentrated to high grade results these properties will be opened up, and I have no doubt but that the results will be good.

"The whole country is full of medium and low grades, and there should be a thousand men employed in this section during the coming year."

Vancouver Island.

It may not be generally known that for many months past weekly shipments of fire clay have been over the E. & N. Railway to the B. C. Pottery and Terra Cotta Co., of Victoria. The shipments have been made from the N.V.C. Co.'s Northfield mine. The fire clay is used in the manufacture of sanitary tiles and fire brick. The fire brick made of this clay have been submitted to very severe tests and are proved to be superior in every respect to those imported from England. The Pottery Company deserve credit for their pluck and enterprise and it is gratifying to know that Nanaimo can supply in abundance the material that they have been the first to utilize.

We are assured that the N.V.C. Co. possess, besides the fire clay found at Northfield, equally good clay in the Protection Shaft and in the slope they are opening in their Harwood properte.

The shipments of coal from the Port of Nanaimo for October amounted to 51,748 tons, an increase of 6,427 tons over September. The New Vancouver Coal Company's shipments for this month are larger than last, by 1,761 tons. The Wellington Colliery's increase is 3,742 tons and that of East Wellington is 024 tons.

The Union Colliery at Comox, which has been shut down for some time, is to reopen, so says President Dunsmuir. Later advices report that the men have started work.

During the month a miner named John Freer sustained serious injury to his back by a fall of timber in the East Wellington colliery.

The Nanaimo *Free Press* in refuting some inaccuracies in an American paper gives some interesting figures of the earnings of the collier and coal operator at Nanaimo: "First, $2.50 is not the average daily pay for the miners,

for the general average in the No. 1 Shaft of the New Vancouver Coal Company, to which the item directly refers, is over $3 per diem. The second, and most serious mis-statement, is that the Company makes $40 out of each miner for every day he works. The average amount of coal mined for each working miner is about four tons per day. For this four tons the Company pay to the miner $3.20. Then in addition there is the expense of the shot-lighters, engineers, firemen, pushers, overmen, bracticers, tracklayers, etc., in and around the mine, to be added to the amount paid the miner before the coal reaches the surface. Then comes the expense of transportation to the wharves and shipping. Then in addition to this if the coal is sent to the principal markets in California, freight at $2 per ton, duty 75 cents per ton, insurance 16 cents per ton, and many other incidental expenses. In addition to these is the money expended in purchasing coal property, sinking shafts, erecting engines, constructing railways, purchasing locomotives, etc., etc., and yet the gross total received for those four tons at San Francisco will not in the present market exceed $24. It will be apparent at a glance therefore that the Company could not receive the $40 gross for the daily product for each miner but $24, out of which have to be taken the heavy and innumerable expenses incident to coal mining. If the Company made $40 per day out of the product of each miner as they have, say 500 actual miners getting coal, that would mean a clean profit of $20,000 per day, 300 days in the year, $6,000,000 a year. We fancy we see Mr. Robins, the Superintendent, smiling on reading these figures, and thinking what a world of anxiety it would take from his shoulders if he could show such a profit at the end of the year. To give our Pythian contemporary an idea of the profits of coal mining to the Company which he directly alludes, we will repeat what is a matter of history. The Vancouver Coal Company have had their present estate over thirty years, and have operated the coal mines, to a greater or less extent, during those three decades, and we are within the mark when stating that the shareholders have not received an average of 2½ per cent per annum interest on the money they invested. Quite a different result to the $6.000,000 per annum as shown by our contemporary's figures.

An electric pump will shortly be erected and put in use in No. 5 shaft of the Wellington Colliery. The pump was brought out from England to be used in the Union mine, but was never erected there.

An improved Shepherd Coal Washer, capable of washing 350 tons of coal a day, now at Wellington, is to be sent up to Union, where it will be erected for use when mines re-open.

By an explosion of powder eight men were more or less injured the other day in No. 1 shaft, Nanaimo Colliery. The men were on the morning shift riding in to their places in two box cars, drawn by the electric motor, when, by some mischance the lid of a powder can belonging to the men in the first car came off, and the powder pouring on to a lighted lamp exploded. One of men it is feared will lose his eyesight.

The necessary pumping machinery having arrived, the work np the Departure Bay shaft of the Wellington collieries has been resumed under the superintendenc of Mr. Haggart. It will be remembered that some few months ago this work was stopped owing to the inflow of water being greater than the existing pumping appliances could control. It is expected, however, that the new machinery will be found fully equal to the task.

Since our last brief notice of the operations of the New Vancouver Coal Mining and Land Company, on Protection Island, the erection of the pithead has been completed, the ropes wound on the drums of the large engine and the cages placed in position, the work of placing the guides in the shaft is also completed and with a few further fittings everything will be in readiness to resume work on Monday next. We understand that it is the company's intention to open out both seams simultaneously at first, and for some time to come this will consist mainly of drift work, straightening out the approaches of the pit bottom, water lodgment, etc. Probably a little over 100 tons daily will be the output from this shaft at first. It will be gradually increased as the works are extended. This coal will have to be binned on the ground until wharves are erected. We are informed the company will start this work next week. The line of the wharf will be carried out about 800 feet to deep water, from a straight line from the shaft, at a slight up-grade at first and afterwards at a slight down-grade to the loading shute. At first ships will lie at the end of the wharf, but later, additions will be made which shall allow two ships to lie on each side of the wharf, and so avoid the hauling off that now takes place at the Nanaimo wharves. With the facilities the company now have at San Francisco, with rapid discharge of steam colliers, in order to make the most of this class of craft, they will erect bunkers and a separate wharf where steamships of large tonnage can be loaded in a few hours if required. Thorough tests have been made in San Francisco of the few hundred tons of the lower seam coal that were shipped to that market a few weeks since with results highly satisfactory to the management and to the agents who will have the handling of this new product in that market. Until the completion of the wharf none of the upper seam coal will be drawn from Protection Island shaft, except what will be dug from the drift around the pit bottom. The coal in the No. 1 level, which extends already several hundred yards across Protection Island, will still be drawn out by the electric motors from the No. 1 or Esplanade shaft. We may mention that the two electric locomotives continue to do good work in the No- 1 level and arrangements have been made with the Edison Company to supply a third locomotive of equal capacity, but with certain modifications of the gearing. The motor is intended to be placed in the No. 3 level, using the small locomotive intended for that level, also in the No. 1 level, through which the great bulk of coal coming from the mine is now being drawn. It is safe to say that when the Protection Island shaft is opened out and the No. 3 level carried on through very fine coal, found on the Protection Island side of the fault recently passed through, the company will be in a position to largely increase the output should the market show the improvement we have so long been looking for.

CANADIAN COMPANIES.

North American Mining Co. (Ltd.)—Has been incorporated under the Quebec Act, for the purpose of carrying on a general mining business in the Province of Quebec. Capital stock, $200,000, divided into 2,000 shares of $100 each. The incorporators are as follows: Alphonse Bayard, civil employee, Cote de la Visitation; Arthur Yale, superintendent of East End abattoirs, of the same place; Ferdinand Bayard, butcher, Montreal; Alfred Montreuil, butcher, Montreal; Guillamme Narcisse Ducharme, manager of the Bank Jacques Cartier, Montreal.

New Rockland Slate Co. (Ltd.)—This company having obtained a separate municipal council for the buildings and property of the company, and separate from that of the township, is petitioning to obtain authority to publish, in English only, all notices, by-laws or resolutions made or passed by said council.

The Ditton Gold Mining Co. (Ltd.)—Gives notice of application under the Dominion Statutes for incorporation, with the purpose of acquiring and working mineral lands in any or all of the Provinces and Territories of the Dominion of Canada. Head office, Toronto, Ont. Capital, $500,000, in 50,000 of ten dollars each. The applicants are as follows: John S. Monahan, mining broker, Toronto; Clarence J. McCuaig, estate agent, Toronto; Arthur S. Thompson, mining broker; Toronto; Franklin M. Gray, barrister, Toronto; John Alfred McAndrew, barrister, Toronto.

The Walton Gold Mining Co. (Ltd.)—Will apply to the Legislative Assembly of New Brunswick for incorporation, with the object of purchasing and leasing lands in the Province of Nova Scotia, and of searching, digging and mining for gold and other metals and minerals therein, and crushing the ore and selling the same, etc. Capital, $20,000, in 20,000 shares of one dollar each. Head office is to be at the Parish of Rothesay, King's County, N.B. The applicants are as follows: Abraham Walton, miner, Shubenacadie, N.S.; John Fenwick Fraser, gentleman, Rothesay, N.B.; Frank Pitfield, accountant, St. John, N.B.; George Forbes, telegraph operator, Shubenacadie, N.S.; Wesley Van Wart, barrister, Fredericton, N.B.; Louis Green, tobacconist, St. John, N.B.

The Consumers' Natural Gas Co. of Dunnville, (Ltd.)—Give notice that application will be made under the Ontario Act for incorporation, to supply natural gas for light heat or power. Head office, Village of Dunnville, Ont. Capital, $4,000, in 80 shares of $50 each. The applicants are as follows: Hugh Asher, Frederick Schalfield, J. H. Michener, Wm. G. Scott, Jeremiah G. Winslow, James A. McIndoe, Charles W. Winslow, James F. Macdonald, all of the Village of Dunnville, Ont.

The Toronto Nickel Co. (Ltd.)—Give notice that application will be made under the Ontario Act for incorporation to explore for, mine and reduce, buy and sell, gold, silver, nickel, copper, iron, lead and other ores and metals, and the by-products of such minerals and ores, &c., &c., and to carry on a general mining, milling, reducing, and refining business. Head office, Toronto. Capital, $3000,000, in 3,000 shares of $100 each. The applicants are: Arthur Kitson, engineer, Philadelphia, Pa.; Dr. George Strawbridge, occulist, of the same place; William C. Scott, attorney-at-law, of the same place; Alex. Keith, merchant, Toronto; and Frank B. Allan, gentleman, of the same place.

Notes on the Steel and Pig Iron Industries of Nova Scotia.*

Thc centre—perhaps the exclusive steel-producing district—of Canada is in the village of Trenton, one mile from the town of New Glasgow, 105 miles from Halifax, in the heart of the iron lands and coal fields of Nova Scotia proper, where the Nova Scotia Forge Company, 1872, and the Nova Scotia Steel Company Limited, 1882, amalgamated, 1889, into the Nova Scotia Steel and Forge Company Limited, capitrl £200,000, divided into 5,000 8 per cent. cumulatiqe preference shares of £20 each, and 5,000 ordinary shares of £20 each, is at the moment performing labour at once of eminent national importance and of great moment to the steel-masters of Britain, who, in the rise of this native industry, are yet more impoverished, restricted and handicapped than ever. Since its inception, this company has experienced unbroken success, and, in spite of inexperience, now discovers that the works are too small to meet the increase of demand, whereupon steps have been taken to enlarge the mills, and a machine shop, 175 ft. by 170 ft., is being erected to receive some heavy tools, inclusive of a lathe 46 feet long, swinging 112 in. between the centres, for heavy marine work, and a 24 in. slotting machine, for crank shafts. In addition, a new 350 ft. by 120 fi. rolling mill is in construction in connection wsth the steel plant. The buildings now cover some four acres of land, holding 450 operatives, and admirably equipped with powerful plant, at which I am constrained to express high, althongh not eulogistic, approval. The Siemens-Martin process here turns out cogging rolls up to 26 in. diameter, steel billets, heavy railway and marine forgings, machinery steel, carriage tiers, sleigh shoes, steel sections, angles, channels, plan beams, fish plates, mould boards, land sides, harrow teeth, cultivator teeth, shaftings, steel bars, springs, &c., which are distributed all over the Dominion of Canada, in New Brunswick, Quebec, specially Ontario (the great centre of the agricultural implement factories), Manitoba, and even the province of British Columbia, likewise the shops of the Michigan Central Railway, Canadian Pacific Railway, Grand Trunk, &c., and as the Nova Scotian mills practically constitute the sole native source of supply, it appears that a wide and increasing field of enterprise is opening to the dirccttorate. Of course the industry is protected against the steelmasters of the south or the steel producers of Britain, but hitherto the British ironmasters have derived some benefit, inasmuch as the requisite supplies of pig iron were, until recently obtained from the latter country, which, under a protection tariff of 16s. 8d. per ton of 2,000 lb. upon pigs, contributed 52,627 tons of iron in pigs, iron kentledge and cast scrap iron during the fiscal year ending June 30, 1891.

As the export market in Canada is of some importance to British dealers and ironmasters I detail the imports of the pigs and scrap into the Dominion during the fiscal year as above :—

	Tons.
Great Britain exported	52,627
British Guiana	226
British West Indies	689
Newfoundland	52
Brazil	1,373
Norway	2
St. Pierre, Newfoundland	52
United States	26,296

Distributed :—

Ontario	34,767
Quebec	37,437
Nova Scotia	7,032
New Brunswick	1,071
British Columbia	1,005
Prince Edward Island	5

Unfortunately, however, for Britain, we are going to lose our markets here [I say unfortunately, for surely Britain's markets are becoming sufficiently restricted), inasmuch as in the inception of the New Glasgow Iron, Coal and Railway Company, the pig iron industry of Canada is at last an accomplished fact. This company—which is largely controlled by the stockholders and directorate of the steel company—was organised two years ago, and after an expenditure of some £120,000, the directors have acquired a very excellent coke and pig iron plant at a point named Ferrona, where within a radius of ten miles all necessary materials for the production of pig iron remain, comprising several varieties of ore suitable for varieties of iron, and a furnace is in actual operation, turning out iron specially adapted for the manufacture of steel. This furnace (capacity 30,000 tons per annum, is of the following dimensions, 70 x 15 ft; three hot-blast Massicks and Crookes stoves, 60 x 17 ft; with cast-house, stock-shed and engine-house complete, and is arranged to permit of the erection of an additional furnace, hot-blast ovens, &c., at an anticipated period when demand shall have increased. In addition a coal-washing plant with storage towers, and a battery of thirty-six Coppée coke ovens have been laid. The steam required to operate the blast engine, coal-washing plant, pumps, &c., is generated in a nest of eight multitubular boilers, stocked with waste gas from the blast furnace and coke ovens. Eleven miles of railroad have been constructed from the site of the furnace to the iron mines and limestone quarries of East River—which have been referred to under my article "The Iron Lands of Nova Scotia" and the generally favourable conditions for the manufacture of pig encourages me to anticipate that "Ferrona" pigs will enjoy fair notoriety upon the Dominion markets. Now, the foregoing is worthy the attention of our ironmasters at home. As stated above, it illustrates that another blow is being struck at our industries in an hour when we are too uneasy thereabout to be comfortable. It is not so much the actual inception in Canada of the steel and pig iron industries which is of consequence from a purely home point of view, as the lesson taught that all nations are becoming more active in industries of every description, thus driving us back upon our lines, restricting our markets, &c., with results sufficiently disastrous. This is, of course, the natural and normal sequence of the colonisation of the west, south and north, and because our

* From Canadian correspondence to the *Colliery Guardian*.

industries must retrograde in a ratio as those of the New World advance. some of our ironmasters should seriously contemplate a traasfer of their capital to the unexploited fields of Canada. Take Ontario, for instance—what is to prevent them from exploiting iron fields, which for extent and riches emulate even those of Pennsylvania. But Ontario is merely one example of that which can be accomplished. Canada is full of chances for lucrative enterprise, and he who is early there shall early profit. As an example of the quickened enterprise in the New World, let me quote even Newfoundland, that torpid land of monopolies and fish. The geography of Newfoundland is something similar to that of the British Isles, especially upon the soath-west coast, where St. George's Bay bears a most remarkable resemblance to the Bristol Channel. The coal measures of Cape Breton dipping north-east into the Atlantic Ocean reappear upon the shore of this bay, one seam, 14 in. at the crop, being of especially fine quality. In the immediate vicinity a hill of magnetic iron ore has been discovered, and towards this speculators are turning some attention. I have not yet sighted a sample of the ore, but the following assay by Professor Pyke, of Toronto University, will assist you to determine its ingredients :—

Metallic	65·3
Silica	5·0
Titanic acid	4·3
Sulphur	*nil*
Phosphorus	*nil*

No steps are, so far as I am aware, being taken as yet to develope this deposit, beyond ascertaining its value, but increased enterprise marks the industrial career of the island. This Newfoundland is an enigma ; the benefits of confederation with Canada are palpable, but the islanders remain outside, to the serious detriment of the industries of the country, but enterprise will certainly throw the tentacles of genius around the iron and coal deposits, and the erection of mills, furnaces and factories in our oldest colony will be another blow at such in Britain. In conclusion, I would explain that I am no pessimist, neither do, begrudge the colonies such success as they have attained to, but I am anxious about the integrity of the commercial supremacy of Britain and the prosperity of our vast industrial populaces, to whom and to which we must pay some more intelligent attention, based upon a true comprehension of the ethics and migratory channels of trade than heretofore. If we could only direct the attention of labour to the brighter circumstances and unexploited realms of the colonies, and persuade some, at least, of our capitalists of the folly of running their industries to death, I think the crisis towards which we are drifting would be materially modified.

A Pneumatic Culm Conveyer.

Messrs. Simpson and Watkins, coal operators at Jermyn, Pa., have put into their breaker at that place a new Mitchell pneumatic culm conveyer, which is the first of its kind in operation in the coal regions of Pennsylvania. The new arrangement for the conveying of culm from the breaker is the invention of R. Y. Mitchell. A local paper states that the invention is most simple, and consists of a common pipe, through which a blast of air is being driven by the ordinary Root blast. Into this pipe in front of the blower the culm is let slide and the blast takes it up and conveys it to its destination. At the Jermyn breaker the blast carries the culm at an angle of 45 degrees to the altitude of 175 feet, and a horizontal distance of 300 feet. It takes from the breaker a ton of culm a minute, and can as easily bring that quantity a mile as 100 feet. It is estimated that it can carry from the breaker a ton of coal culm every 2 minutes of time, and fetch it a distance of 2 miles. It thus does away with the culm draw man, the driver, the headman, the driver on the head, and the dumper, besides with the services of 2 mules. and besides it saves the rolling stock, as no cars are required, no railroad tracks, no pulleys nor rope, and no extra drum in the engine house to hoist the culm. It is a peculiar fact connected with it that although the coal is carried at such a rapid speed, yet the pipe in which it travels is not at all heated or worn by friction, for the fact is, there is no friction in it at all. The coal is borne in the centre of the blast and pipe. The air acts as a cushion and prevents the coal from striking against the sides no matter how many tons the pipe may have. The pneumatic conveyer is practical in the case of factories burning culm, and located at a distance from the culm pile. The culm can be taken right from the pile and delivered into the fire room, and even into the very fire itself if necessary.

Another advantage that it possesses is that it dries the culm wet from the teeth of the breaker, even with an ordinary blast, and where a hot blast is used it makes a thorough separation of the dust, the small pieces of coal, and by the very laws of motion and gravitation it separates the one from the other. When necessary a receptacle can be placed at the mouth of the pipe into which the dust falls. The larger coal is naturally carried farther and drops into another place set apart for that- Thus a cheaper, more thorough, and more satisfactory separation is had than in the present costly, dirty and crude way of washing culm. Further than this a knowledge of the fact that slate does not break into pieces as small as coal, makes it possible by these very means to sepurate the slate from the pure pieces of coal, even in these very small sizes--a thing which the coal workers have not even as much as attempted.

Longwall Working of Seams of Moderate Inclination.

At the annual general meeting of the Federated Institute of Mining Engineers, held at Shelton, England, on September 6th, Edward B. Waim read a paper on the "Application of Longwall Working to Seams of Moderate Inclination in North Staffordshire." This paper was of considerable interest as dealing with the modifications necessary in working coals lying at slopes of 14° to 20° ; where the following special difficulties have to be met : (1) The tendency of the roof to slip and sink back away from the face, thus taking the working weight from the coal ; and (2) the disturbance of the packs, etc., on the higher side of the level gateways caused by the slipping of the roof. The methods adopted in 2 seams, namely, the Hard mine, of 4 feet, and the Cockshead seam of 7½ feet in thickness were described in detail with carefully prepared illustrations. The chief points to be noticed are the laying out of the working faces, which have a slight dip inbye, the direction being such as to give a continuous face-line from the head side of the level to the outbye end of the district, subject to the stallroad being kept at such a gradient that the loader can push the loaded tub to the gate-end without much difficulty, about 1 in 25 being found to be a suitable inclination in practice. Usual attention must also be given to the timbering and packing, in order to prevent the face of the coal being crushed and in setting the timbers it is found advisable to "underset," that is, to fix them at an angle several degrees less than at right angle to the dip of the mine, which gives a certain amount of "sprag" to the timber, and prevents the roof from slipping down hill. It will be easily understood that when the props are exactly perpendicular to the dip the slightest slip in the head of the prop renders it practically useless as a support to the roof.

The regular weight-breaks being nearly at right angles to the dip, the lines of greatest pressure, owing to the additional pull due to gravitation down hill, comes upon the edge of the coal, and in order to throw this forward in advance of the faceline it becomes necessary to sprag the roof, just as it is necessary to sprag the coal while holing. This, however, can only be done to a limited extent, for if it is attempted to support more than a small area of roof the timber will be broken. For this reason the timbering is kept within the smallest possible limits so that, without using an excessive quantity, the roof is kept well supported after the removal of the coal, and the wastes are allowed to break down within an easy distance of the face, so as to get a good supply of packing materials close at hand, at the same time preventing excessive pressure being thrown on the timber by the sinking of the roof in the wastes. It is also important that the posts should be set in exact line at right angles to the face, 3 lines being at regular squared intervals to give vertical support, which is not done if the intervals are triangulated, as is the custom in some districts. The breadth of roof so supported varies from 3 feet 6 inches to 9 feet, the timber being only left in the 9 feet breadth for a very short time after the coal is got down, as the lower row is withdrawn as the work progresses. The 3 rows of posts give effectual support while the packs are being carried forward, and the posts being only 2 feet 3 inches apart, there is much less danger in taking them out than there would be if they were set at greater distances. The author next proceeded to notice the precautions necessary in laying out the working faces and gate roads, but we forbear from noticing these as they can scarcely be usefully given without the illustrations. One of the points, however, appears to call for special comment, namely, the variation in the direction of the main weight-breaks in the different seams with increasing depth. At 220 yards the inclination is 5 degrees within a right angle to the dip. At 220 yards it is exactly perpendicular, and at 470 yards the angle is 6 degrees more than a right angle, which seems to show that with increase of superincumbent pressure the roof is broken in a more nearly vertical direction, and that the variation is progressive. If this be the case, then some of the difficulties of long-wall working in inclined seams will be greatly lessened. The importance of such a result in North Staffordshire, where the coals plunge steadily at a high angle to the westward, can scarcely be overestimated.

Mr. Ernest Craig in another paper describes the working of Rearer coals, a term applied to seams dipping at higher angles than 45 degrees, a condition that prevails at the northern end of the coal field, where the strata are much disturbed, and the lie of the measures in the same pit may vary from horizontal to vertical. In this systetu the coal is worked in lifts or "breadths" not exceeding 120 yards between the main levels, the pillars being exhausted from above downwards. In laying out the ground the lower levels are driven to within 100 yards of the boundary, and a pair of places driven from below upwards on the full rise to within 10 yards of the top of the breadth are made into cage dips, that is provided with platforms and counterbalances running over a brake wheel at the top for lowering the loaded tubs to the level below. Three headings, parallel to the main roads, are then driven in the breadth of coal dividing up into pillars about 40 yards wide and of the full length of the working the coal below these intermediate levels being kept solid for a time. In taking the pillars the face of the upper one is kept 12 to 15 yards in advance of that next below it. Special precautions are required in managing the slewing of the goaves to prevent slipping, and the system is very satisfactory as regards coal saved, although slower yield than from flatter measures.

Improvement in Blast Furnace Methods.

At the recent meeting of the West of Scotland Iron and Steel Institute. Mr. James Riley, president, in delivering his inaugural address said that 10 or 15 years ago the opinion was pretty fully held, if not openly expressed, that the blast furnace was an almost perfect apparatus for the reduction of the ores of iron ; that neither in the direction of economy nor regularity of working was much further progress to be anticipated, and yet what had happened? It had been made apparent in these latter days that many thousands of pounds per annum were being lost in the gases which passed from the furnaces, and were allowed to escape without yielding the treasures they contained. The stoppage of this waste had revivified the almost moribund Scotch pig iron manufacture, and had placed the ironmasters in the position of being able to compete successfully for the supplying of steel works. Economy of working had also been increased by the use of blast of higher temperature and greater pressure, and of furnaces of greater height and capacity. Hence there had resulted the application of special stoves, and numerous other appliances, in which the skill of the engineer, as well as that of the metallurgist and chemist were exhibited. And the end was not yet, for these larger and more complicated installations had made manifest the necessity for efficient control of operations, if serious irregularities in the operations were to be avoided : hence the effort to provide reliable instruments for measuring and automatically recording temperatures of blast, and for controlling and recording uniform and regular *teversal* of stoves.

Many of the irregularities which occurred in the working of blast furnaces would be avoided if accurate measurements of temperatures, etc., could be obtained with facility. He might refer to the presence in pig iron of sulphur and silicon in excessive quantities, one being the result of cold working with possible shortness of basis, the other of too great heat obtained at the expense of fuel. Now, to the steelmaker sulphur was obnoxious, because it produced red-shortness in the steel and was also fatal to good welding. Silicon was obnoxious to him because it diminished the yield, increased the slag, prolonged the conversion, and endangered the result. For the open-hearth process anything over 1½ per cent. of silicon might be considered excessive, and as they were now called upon to accept pig iron with 3 per cent. of that metalloid, it was evident that, adding to this excess the iron it took off with the slag, there was a loss of yield and a lengthening of process which involved serious loss. Silicon in combination with iron was valuable for many purposes, but assuredly not when that iron formed the largest portion of the charge for an open-hearth furnace. This was the case even when working by the acid process, but in the basic process it was more obnoxious, and complicated the operations and vitiated the results. Hence they would appreciate the importance of the efforts which were being made to remove these obnoxious elements from pig iron intended for conversion into steel.

A New Form of Boiler Tubes.—Mr. L. Silverman, Bexley, Kent, has, according to London *Industries*, invented a new form of boiler tube. The tubes for boilers, condensers, etc., constructed according to this invention, have longitudinal ridges and depressions extending nearly their entire length, the ends of the tube being made circular to facilitate the securing of the same to the tube plate. In the manufacture the inventor proceeds as follows : The tube is first made of the required diameter, and then has rolled or otherwise formed in it longitudinal depressions commencing a short distance from one end and terminating a short distance from the other, so that the area of both the internal and external surfaces of the tube are greatly increased. A convenient form of apparatus for forming the depressions comprises a carrier adapted to slide to and fro upon the tube, and provided with as many rolls as there are depressions required, and which are adjustable relatively to the axis of the tube. A mandrel is also provided of the shape corresponding to that which it is required to form the interior of the tube. The mandrel is placed within the tube and arranged to be moved to and fro with the aforesaid carrier In some cases the tube may be formed with alternate corrugated and plain parts.

Winding and Hauling Plant at the Bascoup Colliery.—In the Journal of the British Mining Students, a detailed account is given by Mr. H. W. Hughes of the winding and hauling plant at the No. 5 pit of the Bascoup Colliery, Belgium. A plan of the surface shows three shafts, of which one is used for winding, the output being 1,100 tons per day. Vertical winding engines and cylindrical drums are used. The cage is attached to the rope by seven bridle-chains, the central one being connected to the cage by a spring buffer to take the shock of starting. The bridle-chains are made very long, and, with the aid of a balance platform at the bottom and Stauss props at the top, the changing of the tubs is done very rapidly. The Stauss props, which are fully described, by an arrangement of levers and by the form of the keps, hold the cage firmly, but yet can be withdrawn while the full weight of the cage is resting upon them, so that the engine does not have to be reversed. Rail guides supported by H steel girders are employed. The descent and ascent of the men is effected in a separate shaft by means of double-acting man engines. An elaborate system of endless chain haulage has been installed. Full illustrations are given of all the special features described.

Electric Pumping Plants.—Mr. F. M. Wheeler illustrates several mine pumps driven by electricity, The first of these, at the Hamilton Ore Company's mines, will lift 200 gallons per minute to a height of 1500 feet. It is driven by a Thomson-Van Depoele motor, and the gearing is encased in an oil chamber and provided with arrangements to take up wear. The second was built for the Poor Man mine to raise 500 gallons per minute to a height of 1000 feet. Worm gearing running in an oil chamber is used between the pump and the motor, which is of the Edison vertical type. A note on the electric pumping plant at South Pontop Colliery is given by Mr. J. R. Ritson. The dynamo gives 20 amperes at 370 volts or 9¾ horse-power at 1000 revolutions, and the current is taken to a distance of 3700 yards by insulated lead and return cables. A series-wound motor, working at 1,200 revolutions, uses 7.8 electrical horse-power and drives a centrifugal pump which lifts 200 gallons per minute through 300 yards of pipe with a vertical rise of 31 feet. The pump and motor are mounted on a carriage so as to be lowered as the water falls. The efficiency of the centrifugal pump is low, being only 33 per cent. From brake horse-power to water delivered the efficiency is 14 per cent. The cost per day is 19s. 6d., as compared with 25s. for horse pumping.—(Journal of the British Society of Mining Students, vol. 14, pp. 82-84.) Some notes on a small electric pumping plant at the Shireland Colliery are given by Mr. M. Deacon. A 24 horse-power dynamo gives the current for lighting and pumping. The pump is of a three-throw horizontal type, driven by a two horse-power motor running at 900 revolutions and geared down from 25 to 1. The motor and pump are placed on a light frame so as to be portable. A safety commutator with inside brushes is used on the motor, and is cleaned daily The quantity of water being pumped is about 40 gallons per minute against a gauge pressure of 26lbs. per square inch. A series of tests showed that the indicated horse-power of the engine running light and loaded as above was 7.3 and 11.29 respectively: the dynamo gave 118 volts and 17 amperes: the motor 98 volts and 17 amperes: the electrical horse-power given by the dynamo, 2.67, or 23.65 per cent. of that given by the engine. The total cost per annum is estimated at 103 pounds sterling, ten shillings, as compared with 657 pounds sterling for hand pumping. As the plant is designed for further extensions, the load is very light, and the efficiency accordingly low, being only 6½ per cent at the pump. There is a loss of 20 per cent. in transmission owing to the low voltage employed. (Transactions of the Federated Institution of Mining Engineers, vol. 3, pp. 191-195.) Some notes on an electric transmission plant at the East Howle Colliery are given by Mr. H. Palmer. A compound-wound Crompton dynamo, which gives 60 amperes at 550 volts at 770 revolutions, is driven by a pair of vertical high-pressure engines running at 160 revolutions per minute. The positive led consists of 3000 yards of insulated 19/16 copper cable. The pumps are placed two miles from the shaft, and both are driven by series-wound motors with a current at 500 volts. In No. 1 the motor running at 1100 revolutions, is geared down 15 to 1, and drives a pair of 7 inch double-acting pumps of 13 inch stroke. No. 2 motor runs at 1,200 revolutions, is geared down 128 to 3, and drives a 9 inch double-acting pump of 36 inch stroke. The water is pumped through 800 yards of a 9 inch pipe, a size which is too small, but there is ample power from the waste gases of the coke-ovens. The results of a trial are as follows:—

	Indicated Horse Power.	Percentage of Total Power.
Loss in Engine.....	12.00	22.30
" Generator.....	3.62	6.72
" Cables.....	7.04	13.05
" Motors.....	3.36	6.25
Friction of Pump and Pipes	18.94	35.28
Water lifted.....	8.80	16.40
	53.76	100.00

The total cost was £2157, including the cost of fifty-three incandescent lamps also run off the generator.—(Transactions of the Federated Institution of Mining Engineers, vol. 3, pp. 271-278.)

Removing Deposits From Pipes in Shafts.—Mr. R. T. Swallow describes the method adopted for removing deposits from the inside of rising main pipes in a shaft at the Hepburn colliery. These mains are constructed of 118 cast iron pipes, in lengths of 9 feet, and varying in diameter from 9¼ to 10¼ inches at the surface. As one of the vertical pipes was split it was removed, and the water way was found to be reduced from 9 to 6½ inches in diameter. The broken pipe was replaced, and the pipes were cleaned by a process anologous to rope-boring of deep bore holes. Two small pulley sheaves were arranged to lead the rope from the winding drum so as to hang in the centre of the pipes, and a specially designed cutter was attached to the end of the rope. The cutter was loaded with 4cwt. of chain, and consisted of a horizontal piece of bar-iron, fitted with steel springs on each of the sides, and each carrying two knives. The cutter was reciprocated in the pipe, and a stream of water turned down it to wash away the debris. This operation was repeated twice throughout the whole length of the pipes, the second time the cutters being to the full diameter required. Altogether 11½ hours were required for the cleaning process and five men were required. The operation did not interfere with the use of the shaft, and five tons of deposit were removed at a trifling cost from the pipes, which had been in use for five years.

The Protection of Wire Ropes.—A short time ago reference was made in these columns to a new wire rope, known as Cheeseman's A. C. L. wire rope, which is being introduced by the Hartlepool Ropery Company Limited. It is so manufactured that in the process of its formation the cores and wires are all thoroughly coated with a composition called glissantoline, which is an excellent preservative of iron and steel. This fills up the interstices of the rope, and makes it impervious to the causes of corrosion or rust, such as steam and acid waters found in the workings of mines or elsewhere, at the same time acting as a constant lubricant to the rope and individual wires, thus obtaining greater flexibility, lessened friction and maximum durability of the rope. The following tests may be of interest:—(1) Sample, immersed twelve weeks in solution, one part salt, three parts water, unaffected; (2) sample, ten weeks over steam exhaust; (3) sample, ten weeks in hot water, 140 degs. Fahr.; (4) sample, twenty-two days strong solution sulphuric acid; (5) sample, twenty-two days strong solution sulphuric acid, at temperature 130 degs. Cent., or 280 degs. Fahr.; (6) sample, twelve weeks in sea water; (7) sample, seventeen weeks in open air, subject to all atmospherical changes; (8) sample, twelve weeks buried in earth, just sufficiently low enough to receive moisture from an overflow of water, 140 degs. Fahr. twelve hours per day; (9) sample, two weeks in strongest solution ammonia. All the above samples were totally unaffected.

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Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

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Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

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The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 10 cents on every ton sold.

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New York *Sun*, Sept. 12.—"The Crawford Gold extractor, which was recently put into the Richmond Hill at Hillsborough, New Mexico, is giving satisfaction. It has been tested on runs of ores from different mines in the district with uniform good results."

Salt Lake *Times*, Aug. 28.—"Mr. Woodman came in from Deep Creek yesterday, where he has been for a month or six weeks, and he pronounces the Crawford mill a perfect success, saying that since the mill started it has saved 92 per cent. of the assay value of the Gold Hill ores, some of which are very rebellious."

John C. Smith, Supt. of the Ogema Mining and Smelting Co., says: "It gives me great pleasure to add my testimony in favor of the Crawford mill in every way, as to its 'gold saving qualities,' 'practically no loss of mercury,' 'small volume of water required per ton of ore,' great ease of manipulation,' also as to its portability to mines remote from railroads, and 'ease of setting up ready for operation.'"

L. J. Boyd, M.E., Supt. Montagu Mines, after personally supervising a test on arsenical ore says: "The results were simply wonderful. I am personally perfectly satisfied with this system of ore treatment, and should advise its adoption, as the experiments were carried on by my personal superintendence. Similar ore was treated by the Montagu stamp mill showing a difference of 100 per cent. in favor of the Crawford mill."

Fredericksburg, Va., *Free Lance*, Sept. 6.—"L. G. Johnston, of this city, in an interview, said he sent to the M.G.E. Co., N.Y., one ton of very low grade sulphuret ore from the mines of the Powhattan L. & Mining Co., Culpepper Co. He went to New York and personally witnessed the working of the ore. The results of ten different samples of ore, averaging in assay value from $2.13 to $7.35 per ton, showed a saving of 88 per cent. of the value by actual mill run, this without the use of chemicals or fire. These results were so satisfactory that a large sized mill will be placed on the property at once."

W. D. Sutherland, Secretary of the Salisbury Gold Mining Co., of Nova Scotia, after having over 4 tons of ore treated by the Crawford mill, says: "Sample of the tailings taken during the run showed by assay an equivalent to 0.033 oz. to the ton. This evidence of the capability of the Crawford mill to extract all but a trace of the gold which the ore may contain must be considered of importance by all who are interested in the question of improved methods of milling gold from the ore. The test alluded to was made under the supervision of our company through trustworthy agents."

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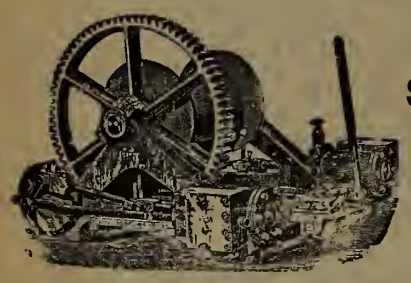

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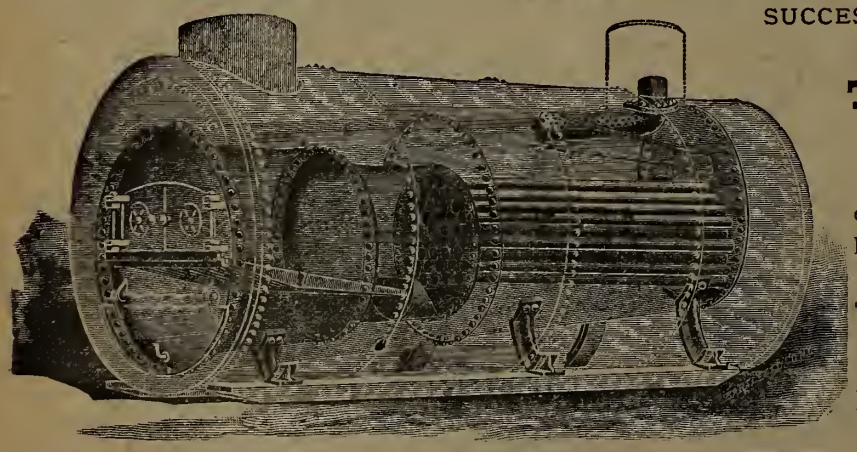

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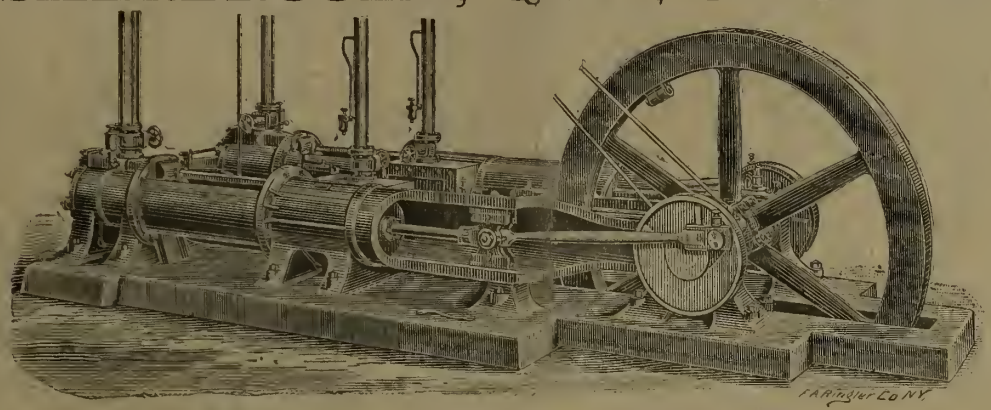

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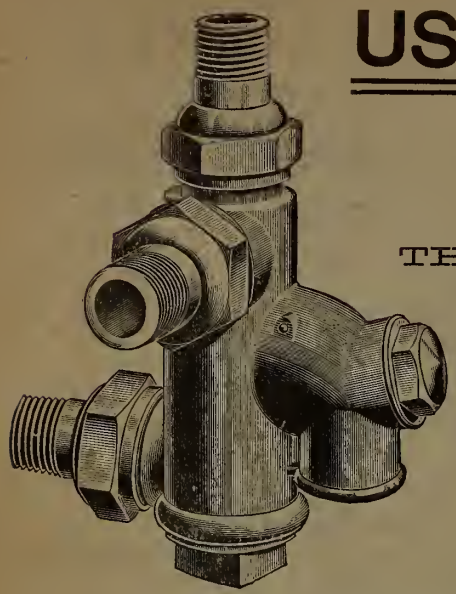

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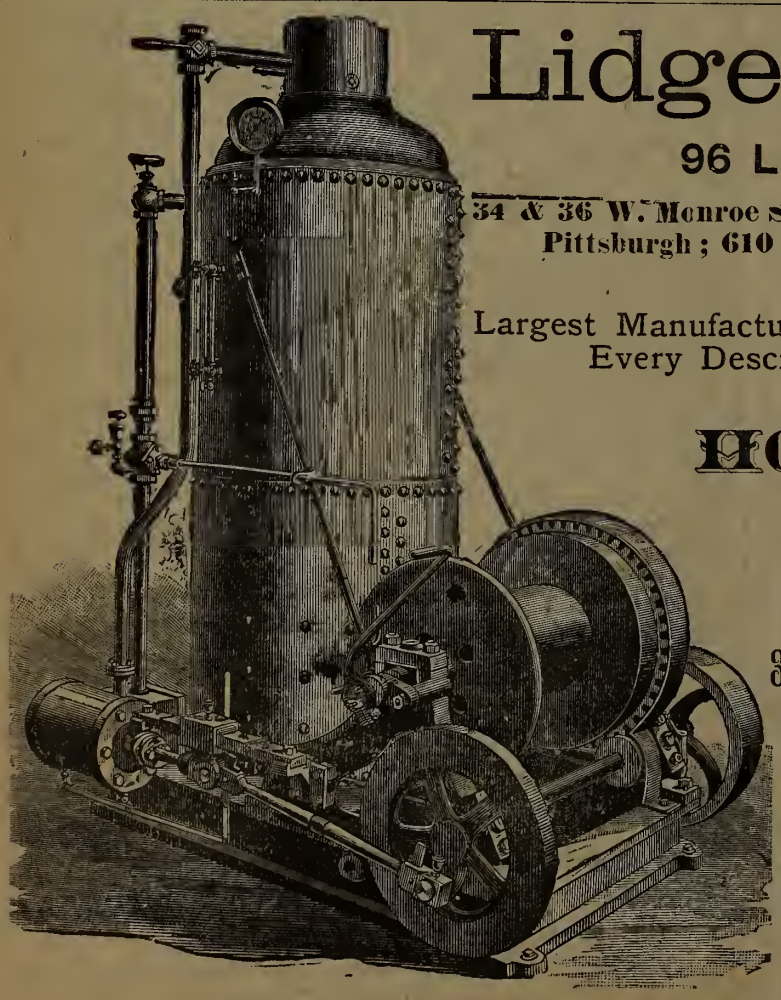

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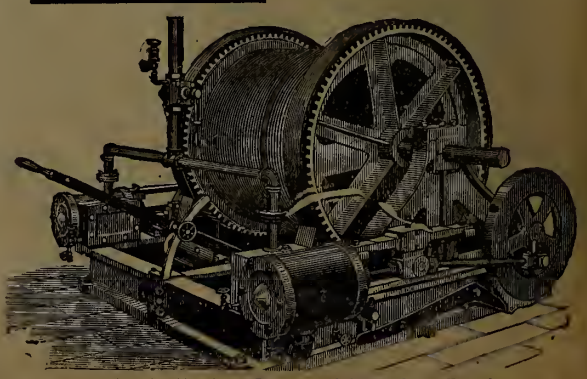

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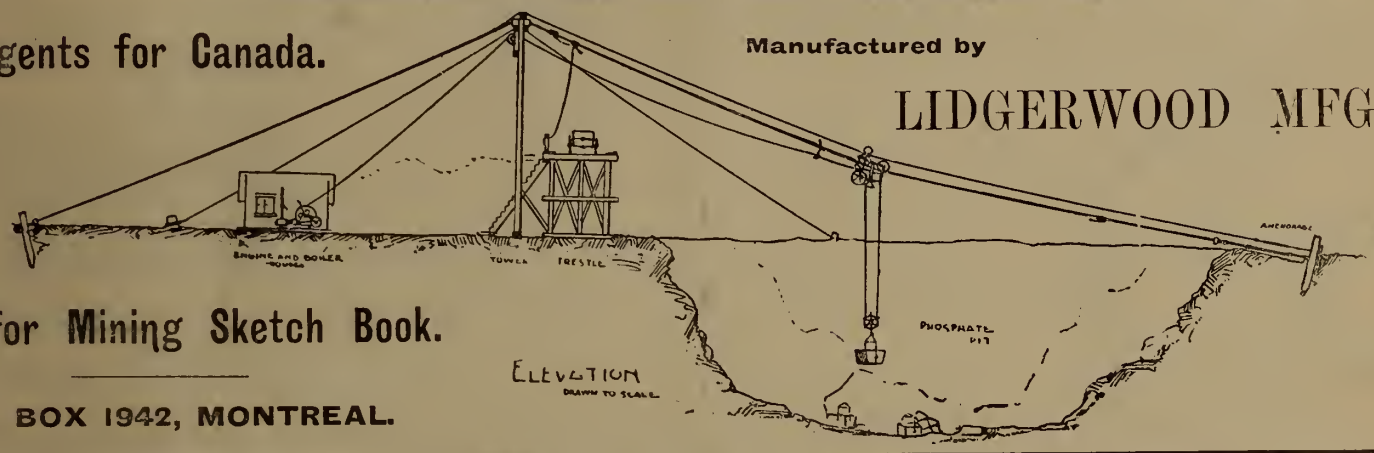

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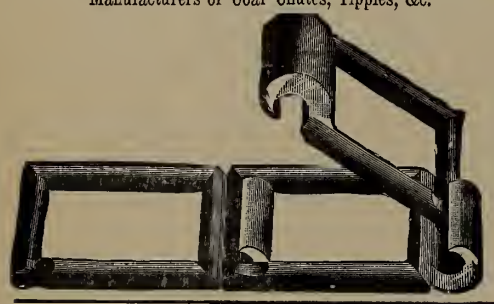

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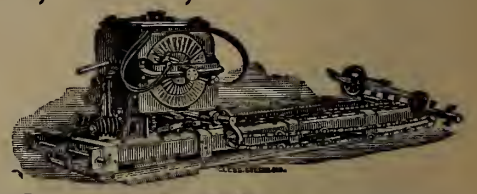

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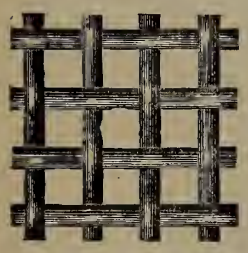

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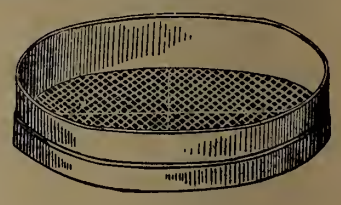

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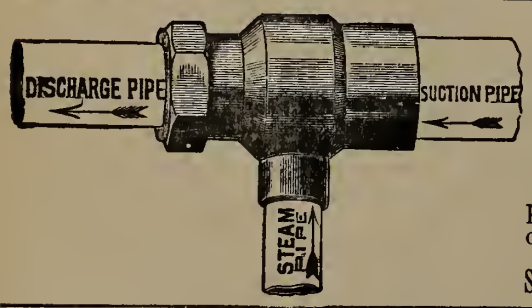

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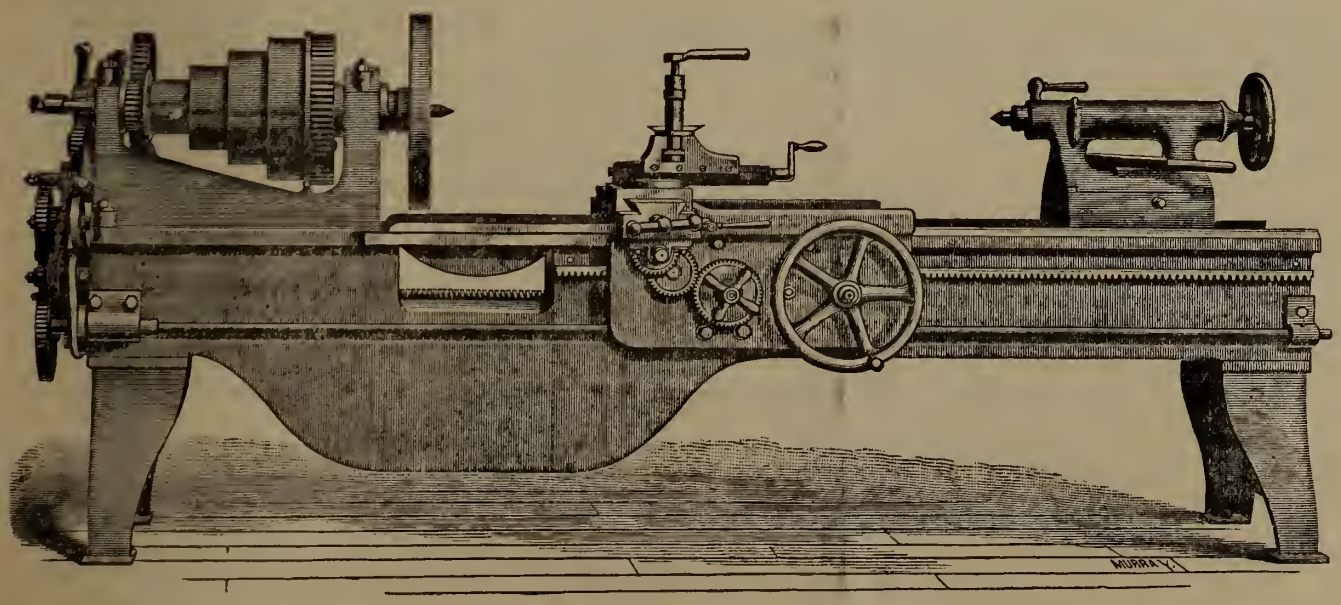

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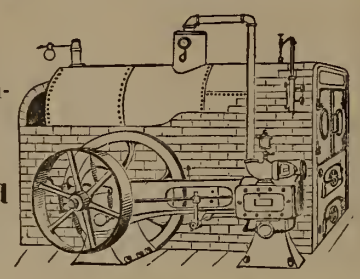

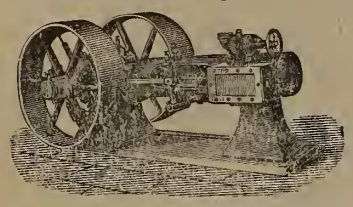

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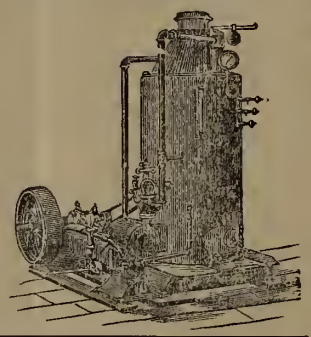

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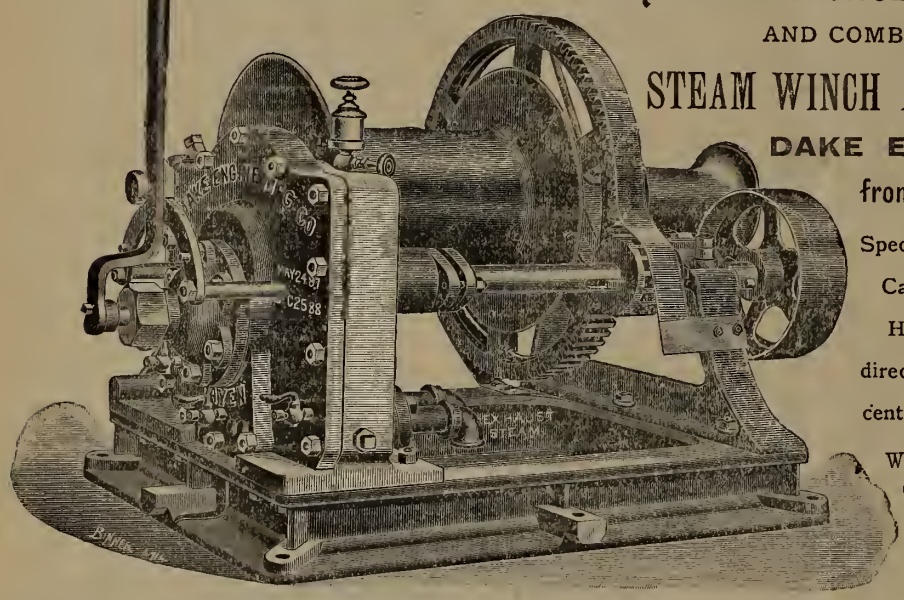

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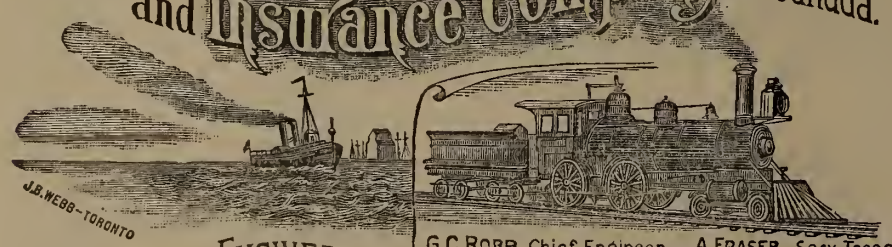

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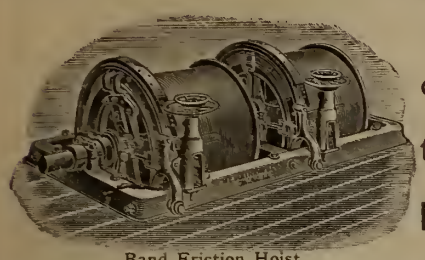

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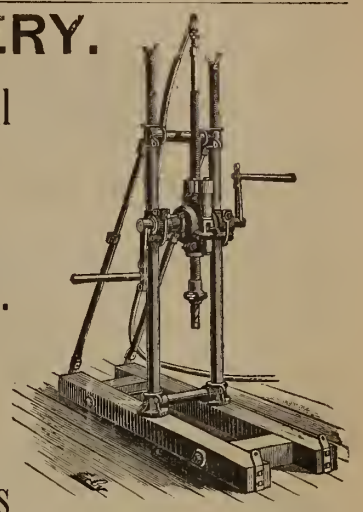

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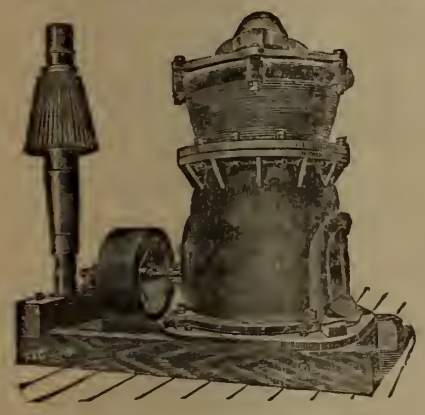

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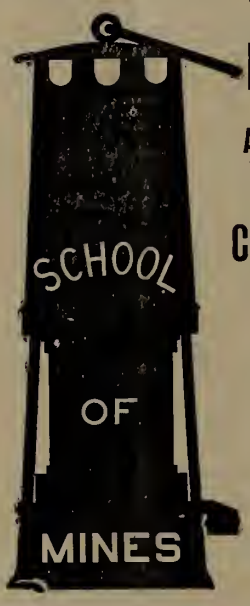

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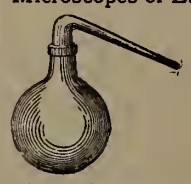

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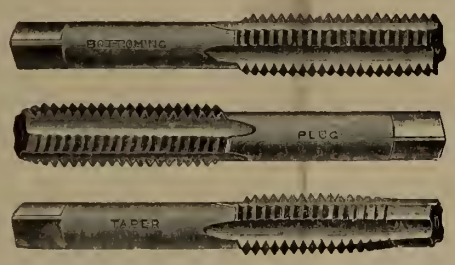

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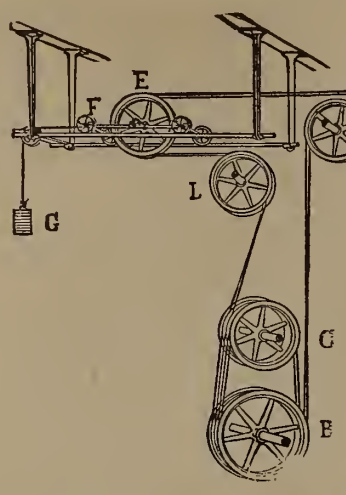

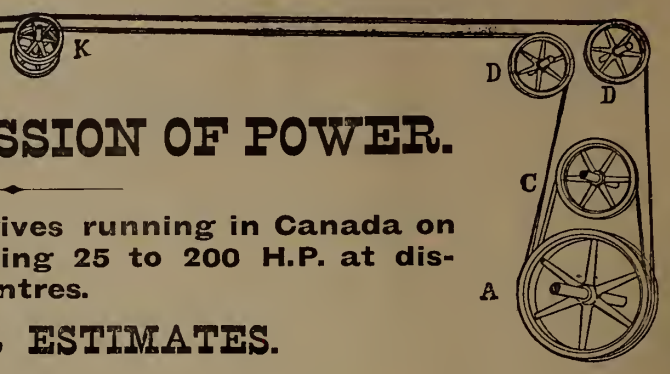

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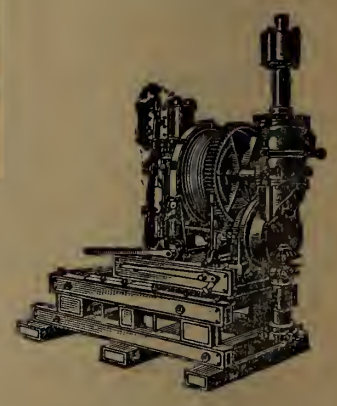

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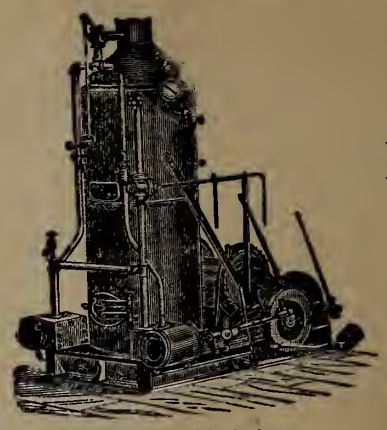

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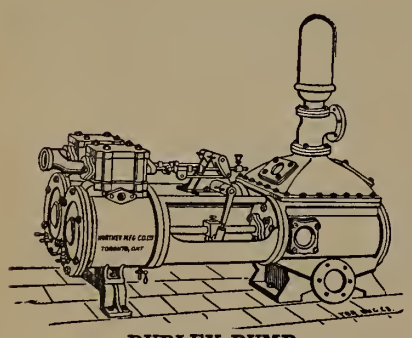

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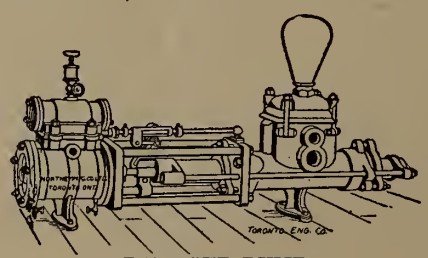

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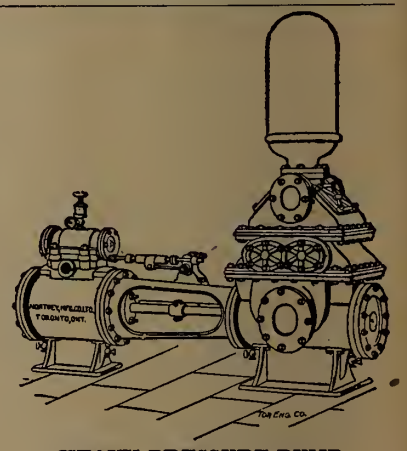

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CANADIAN MINING & MECHANICAL REVIEW

CONDUCTED BY - - - - - - B. T. A. BELL.

THE OFFICIAL ORGAN

—OF—

THE GOLD MINER'S ASSOCIATION OF NOVA SCOTIA,

THE UNITED MINING SOCIETY OF NOVA SCOTIA,

THE ASBESTOS CLUB, QUEBEC,

THE GENERAL MINING ASSOCIATION OF QUEBEC.

THE following Resolutions of Council indicate beyond a peradventure the status of THE REVIEW as the exponent of the Canadian Mineral Industries:—

The Gold Miners' Association of Nova Scotia.

"At the annual meeting of the Gold Miners' Association of Nova Scotia, held at Halifax on 6th March, 1889, THE CANADIAN MINING REVIEW was adopted the official organ of this Association.

(Signed), B. C. WILSON, *President.*
G. J. PARTINGTON, *Secretary.*

The Mining Society of Nova Scotia.

"Moved by Mr. R. G. Leckie, seconded by Mr. C. A. Dimock, That the thanks of the Society be tendered to Mr. B. T. A. Bell for his kind offer placing the columns of THE REVIEW at the disposal of the Society; and that THE CANADIAN MINING REVIEW is hereby appointed the official organ of the Society."

(Signed), H. S. POOLE, *President,*
H. M. WYLDE, *Secretary.*

The Ashestos Club, (Quehec.)

"Resolved: That THE CANADIAN MINING REVIEW is, by authority of the Members and Council, hereby appointed the official organ of the Asbestos Club."

(Signed), D. A. BROWN, *President.*
A. M. EVANS, *Secretary.*

The General Mining Association of the Province of Quehec.

At a meeting of Council held at Montreal on Friday, 6th May, 1891, it was moved by Captain Adams, seconded by Mr. R. T. Hopper, and resolved: That THE CANADIAN MINING REVIEW be the official organ of the Association.

(Signed), GEORGE IRVINE, *President.*
B. T. A. BELL, *Secretary.*"

OFFICES:

Victoria Chambers, 140 Wellington Street, OTTAWA.

Vol. XI. DECEMBER, 1892. No. 12.

The Accountant of the S. and L. Co. was not a Party to the Sale of Areas.

In our charges against the Canadian management of the Sydney and Louisburg Coal and Railway Company, published in the October issue of the REVIEW, the name of the accountant was mentioned as being a party with certain other officials in the sale of coal areas to the company. We withdraw this official's name from our statement and hasten to express an apology for its publication. The REVIEW desires to do no one an injustice.

The Canadian Asbestos Mining Industry in 1892.

Mining in the Province of Quebec, as a whole, has been extremely dull during the past year. Though asbestos was not quite so badly neglected as phosphate (the two minerals representing, next to copper and mica, the most important mining industries of the Province), the beginning of the year found all the asbestos mines, with one or two insignificant exceptions, shut down since November or December, 1891—the fact being due as much to the necessity of re-establishing a proper relation between the output of the mines and demand of manufacturers, as to a very obnoxious mining legislation, taxing instead of encouraging mining, and, at that, taxing on the gross value of the product irrespective whether or not the same be profitable. At the end of the year we may confidently say we have been successful in both objects—the market has assumed a brighter outlook, the mining law has been changed, and the tax clauses as well as certain issues respecting the mining right, eliminated.

Work was resumed in the month of April by the Bell's Asbestos Company, King Bros., Beaver Asbestos Company in Thetford; and by the Glasgow and Montreal Asbestos Company, United Asbestos Company and Anglo-Canadian Asbestos Company, at Black Lake. The Johnson's Company started up their Thetford mines about the end of May. Altogether closed, remained the Ward Ross Company's mines at Thetford, the Johnson Company's mines on Lot 30, Range B, Coleraine, the Central mines on Lot 32, Range B, Coleraine, and partially, the American Asbestos Company's mines, the latter working exclusively on a stock of cobbing stones from the previous years.

Prospecting and developing was continued after snow on the following properties: Reed's mines (Lots 27, 28 and 29, Range A, Township Coleraine, County Megantic,) with a small force of men, aided by a well equipped plant of machinery, and carried on through the summer, we understand, with satisfactory results.

H. W. Johns Manufacturing Company's mine (Lot 26, Range A, Township Coleraine, County Megantic), encouraging the owners to change their horse-power hoisting plant into a steam power plant in the fall of the year, for speedier development; on Lot 13, Range 6, Township Broughton, County Beauce, (Walsh & Mulvena proprietors); on Lot 14, Range 8, Township Broughton, County Beauce, Williams Mining Company; on W. H. Lambley's mine in south west part of mining block A, Coleraine, County Megantic, not been operated since autumn of 1890. Lots 10 and 11, Range 8, Township of Templeton, County of Ottawa, Templeton Asbestos Company. Lot 10, Range 3, Township Shipton, County Richmond, St. Cyr Mining Company.

Prospecting was also done on Lot 16, Range 8, Township Thetford, County Megantic; Lot 6, Range 5, Township Thetford, County Megantic; Lot 15, Range 8, Township Broughton, County Beauce; Lot 12, Range 4, Township Broughton, County Beauce; Lots 27 and 28, Range C, Township Coleraine, County Megantic; Lot 32, Range A, Township Coleraine, County Megantic.

The shipments of asbestos during the year up to the time of going to press, have been about 5,565 tons, estimated on an average load of 15 tons per car, and 371 cars. Full returns are not receivable before February next.

The production of all the mines combined for the running year is estimated at from 5,500 to 6,000 tons of all grades, which shows a decrease of about 3,000 tons against 1891, and nearly 4,000 tons against 1890, in which year the highest figure in the history of the asbestos industry had been reached.

This decrease, however, is not at all due to an inferior quality of working ground, but to the endeavour of the miners to re-establish as quickly as possible a proper relation of the output and the demand on the part of manufacturers of crude asbestos, which had been somewhat disturbed, chiefly by the enormous increase of the output during the two preceding years, with which the manufacture held no equal steps. There is no doubt that up to 1890, the manufacturers consumed the output of the mines as fast as it was produced, which shows that the manufacturing business increased yearly since 1884, between 1,100 and 1,700 tons a year, and consumed in 1889 something like 6,000 tons or a liitle over—this quantity was then all the mines were able to produce. Through the introduction of modern and most efficient mining machinery at most of the mines (American Asbestos Company, United Asbestos Company, King Bros., Bell's Asbestos Company, Thetford Asbestos Company, Reed's mine, W. H. Jeffrey and others) at nearly the same time, (between 1889 and 1890), this output was suddenly raised about 3,800 tons in 1890, and about 3,000 in 1891, compared with 1889, which naturally left a considerable surplus of crude asbestos on the market. We may, however, take it for granted that the use of manufactured asbestos goods has continued to increase, at least at the same rate as in the period from 1884 to 1890, viz: at an average of about 1,500 tons a year, and this leads to the conclusion that the demand in the coming years will be up again to the capacity of all the mines combined, which capacity, considering that there are no new discoveries of any importance made, has pretty near reached the top with an output of between 10,000 and 11,000 tons a year; and while it may be advisable to continue mining in the coming year on conservative lines, the outlook is bright and a steady and profitable business may be expected. It is, therefore, clear that prices during the year, have remained very firm, probably with the exception of a few small parcels in hands of third parties. Average price quotations are about $200 for No. 1, $100 for No. 2, $50 for No. 3, with due allowance for superior and inferior grading. No. 3 found throughout the year a ready market, and anything not promptly taken by American manufacturers could be sold on the European market—a feature in the trade which is well worth the close attention of the miners. No. 1 was firm with limited demand, owing to above-stated facts. No. 2 somewhat neglected. Freight rates were high all the year round: New York, 28 cents per 100 lbs.; London, 32·86 to 36·08; Liverpool, 32·86 to 36·08; Rotterdam, 42·52 to 44·23.

Of important improvements at the mines, the following deserve mention: The Bells Asbestos Company of Thetford, as well as the United Asbestos Company of Black Lake, have earnestly approached the dump question, that is, the further disposition of waste rock,

which became a vital question to both of these companies, the former having reached with their dumps the line of the Quebec Central Railway, the latter the village built up on the westerly end of their property. The Bells Asbestos Company, under the superintendence of Mr. George R. Smith, successor to the late Mr. Thomas Sheridan, solved their problem, by connecting all their works by a railway which crosses, by means of an overhead bridge, the Quebec Central Railway track. Side dumping cars, of about four tons capacity, have been put in use, and a locomotive runs the cars over above mentioned bridge out on a new dumping ground about 1,200 feet from the working places or pits, towards the Thetford river. The pits as well are connected by rail with a series of new cobbing or store-sheds, the railway station, etc.

The United Asbestos Company has adopted the plan of their manager, Mr. John J. Penhale, in building an inclined single track tramway along their southerly line, by means of which the loaded trucks will be taken up the hills, a distance of about 3,800 feet, and dumped on the northerly slope of the hill, towards the Cariboo Lake. A 12 x 15 Copeland & Bacon reversible winding engine has been put in place for the purpose, and the whole will be in running order at the beginning of next season.

The H. W. Johns Manufacturing Company on their Lot 26, Range A, Coleraine, have put in an efficient boiler and hoisting plant (supplied by Messrs. Copeland & Bacon, of New York,) which will greatly facilitate the development of the property.

The Beaver Asbestos Company has built a large cobbing shed and steam dryer alongside the track of the Quebec Central Railway, the latter having provided them with a siding.

The St. Cyr Mining Company, of Danville, has put in a number of crushers, we understand, to carry out a contract with Mr. W. H. Jeffrey, to overwork the dumps of his mines on Lot 6, Range 3, Shipton, County Richmond.

The Williams Mining Company, of Broughton, has put up horse derricks to aid the development of their property on Lot 13, Range 8, Broughton, County Beauce.

Changes in management of mines took place at the Bell's Asbestos Company, by the deeply lamented death of Mr. Thomas Sheridan, succeeded, as already mentioned, by Mr. George R. Smith; at the mines of the Anglo-Canadian Asbestos Company, Mr. Wm. Clerihue, superintendent, resigned and was succeeded by Capt. Wm. Prideaux; while the American Asbestos Company, Ltd., loses the services of Mr. E. Wertheim who resigns his position as Managing Director of the Company at the beginning of the year.

At the time of going to press all the mines have shut down for the winter, with the exception of those of Mr. W. H. Jeffrey and the Thetford Mining Company, at Thetford. The Bells Asbestos Company have shut down their pits, but keep a gang of men and boys to clean up their cobbing stones and do some other work around the mines. The Beaver Asbestos Company retain a small gang of men to do some stripping work. The Anglo-Canadian Asbestos Company are continuing work with about twenty men. Messrs. King Bros. on Lot 26, Range 6, township of Ireland, County of Megantic (near Black Lake Station), will also carry on exploration work during the winter.

L. A. KLEIN.

Another Strike at Springhill.

On 18th instant the miners at the collieries of the Cumberland Railway and Coal Company went out on strike. The immediate cause of the trouble is a revival of the grievance respecting short weight and docking, which occasioned the last lock-out. At the time of the former strike an agreement was made between the representatives of the men and the late manager, Mr. Swift, which was in part superseded by another agreement made between the committee and Manager McInnis, on November 11th, 1891, as follows :—

Memorandum of agreement entered into between Alexander McInnis, manager, as representing the Cumberland Railway and Coal company, on the one part, and Malcolm Blue and E. B. Paul, representing the mine employees of said company, on the other part :

First. It is agreed that the standard measure for boxes sent from the various slopes shall be an average of six inches less than level full, when said boxes reach the surface, that is to say, the fillers of any box of coal, or the parties responsible for sending out the coal, shall be liable to no fine or other punishment should the coal in the box not be lower than six inches from being level full.

Second. Should the coal in any box be lower than six inches from being level full, the filler or party responsible for sending out the same said box, shall be told and warned.

Third. Should on the following day the party responsible for sending out a short or light box the previous day repeat the offence he shall be liable to a fine of half the price paid for said box.

Fourth. Should an offence be committed by the same party three days in succession, then the offender shall be dealt with by the manager, provided always that if objection be taken by any party accused to the judgment or finding of the manager in any case of shortage that may arise, or of alleged shortage, whether it be a first, second or third offence, or alleged offence, the party accused may appeal from any decision to a board of arbitrators, one of whom shall be appointed by the manager, one by the appellant, or pioneer lodge acting in his behalf, these two to appoint a third in case of failure to agree on any matter submitted. The appellant shall have the privilege of presenting evidence on his own behalf, the manager having a like privilege in support of his decision.

This agreement or arrangement shall apply to the west slope until the proposed scales are in position, or until such time as the agreement is cancelled.

The agreement shall terminate at the expiry of fourteen days after notice has been given by either party of its desire to terminate the agreement.

The agreement shall apply to east and north slopes until the agreement is terminated in the manner above mentioned, or until another agreement is entered into.

The foregoing agreement, the men allege, was in full force up to last Wednesday, when Manager McInnis, without giving the necessary notice of fourteen days, issued the following general circular to underground officials and petty bosses :—

MANAGER'S OFFICE,
December 14th, 1892.

You are hereby notified that in future it will be part of your duty to see that boxes are properly filled at the face, and should you find any box or boxes not filled level full you are hereby instructed to send the set or sets of men out of the pit immediately whose tally is on the box and refer them to the underground manager, who will deal with them. Your prompt attention is required to the above.

Acting under these instructions the officials sent several miners out of the pit, who were told they could return to work by agreeing to pay a fine of $2 each. The men appealed to the union, and Pioneer lodge remonstrated with Manager McInnis and General Manager Cowans, but failing to agree the strike was ordered.

Sydney Whitewashers and the Canadian Mining Review.

(The North Sydney Herald.)

The Sydney papers are vieing with each other in the task of whitewashing Mr. Kennelly from the references made to him by the Ottawa MINING REVIEW, in its October and November issues. It is refreshing to see the "down town sheet" and the "up town fakir sheet," as they playfully term each other during the progress of their fratricidal encounters, varying the monotony of their interminable squabbles over civic matters. The Herald does not share in its Sydney contemporaries' suddenly acquired admiration for Mr. Kennelly. More than this we do not desire to say anything further about him here, situated as he is at present. But at the same time we cannot help feeling that something is due to the MINING REVIEW in this matter, and that false statements published with a view to deceive the local public as to the attitude of that paper should be shown up in their proper light. The REVIEW is evidently acting in this matter from disinterested and highly commendable motives, and in pursuance of a public spirited policy adopted by the editor some time ago, having no material advantage beyond an enhanced public reputation to reap therefrom, and having everything to risk from a hasty and ill-matured line of action.

In an obviously inspired article in its last week's issue, the reporter informed the public that Mr. Bell, the editor of the MINING REVIEW, had "unintentionally or otherwise—principally otherwise"—suppressed correspondence between his own and Mr. Kennelly's solicitors, in which the former made overtures for a compromise, which were promptly declined. The inference that the public were intended to draw from this is very evident; but anyone who read what the REVIEW wrote on this matter in its November issue, published after dire threats of legal proceedings had been fired at the editor by Mr. Kennelly's lawyers, must have come to the conclusion that there was no tendency on the REVIEW's part to take back water, but that the efforts for a compromise emanated from the other side. We certainly came to that conclusion, but we have since made assurance doubly sure, and are now in a position to state authoritatively that there is not an atom of truth in the Sydney paper's statements; and that, furthermore, so far from seeking to avoid a law suit, the editor of the REVIEW has been *twice* notified that if an apology was made proceedings would be dropped, so that the "boot seems to be altogether on the other foot."

It is not manly to hit an opponent when he is down, but neither is it sportsmanlike for the recumbent one to try to improve his position by telling what is contrary to fact about his adversary.

In conclusion we offer our opinion that the overdone adulation showered upon his new client by the astute little potentate who is said to control the Advocate, is not likely to enlist sympathy for the martyr whose cause he is championing. His, however, is the consoling reflection that it will be all paid for in the "sweet by and by."

EN PASSANT.

On and after the first of the year all new subscriptions and renewals will be charged at the rate of three dollars. Readers please note this.

A deputation from the General Mining Convention of Quebec was appointed at a recent meeting, to interview the Quebec Government with reference to the obnoxious and burdensome nature of the Powder License Tax. This must be removed or ameliorated if mining is to prosper in the Province.

The Mining Society of Nova Scotia held a most successful meeting on Thursday, 8th instant. As usual a full report of the proceedings will be found in this issue. The Society will hold a special session at Montreal in February, during the sessions of the International Mining Convention.

Arrangements for the International Mining Convention, at Montreal, in February, are going ahead satisfactorily. The programme, subject to revision of course, may be stated in outline as follows: On Tuesday evening, 21st February, the formal opening will take place at McGill University, when it is hoped addresses of welcome will be delivered by His Excellency tha Governor-General, Sir John S. D. Thompson, the Hon. E. J. Flynn, Sir William J. Dawson, and others. On Wednesday morning and afternoon the American Institute of Mining Engineers, the General Mining Association of Quebec, and the Mining Society of Nova Scotia, will hold separate sessions for the transaction of business. In the evening visiting engineers and their lady friends will be conducted in sleighs to the Mount Royal Toboggan Slides, and thereafter to an entertainment in the M.A.A. club house, given by the Montreal and St. George's Showshoe Clubs. On Thursday morning and afternoon a combined convention of all mining men will open, when papers on Canadian mining legislation, our mining industries, mining practice, mineral resources, and other subjects of interest and importance to Canadian mining men will be discussed. In the evening an invitation will be extended by the Governors of McGill to attend a conversazione and the formal opening of the Engineering Buildings, now completed and fully equipped for the training of civil, mechanical, and mining engineers. The Governor-General and the Premier are expected to deliver addresses on the occasion. On Friday morning visitors will be the guests of the Canadian Society of Civil Engineers, under whose direction excursions will be made to some of the principal engineering and industrial establishments in Montreal and vicinity. In the afternoon a final session of the Convention will take place. It is hoped to be able to arrange a fancy dress carnival at the Victoria Skating Rink for the evening. On Saturday the party will leave by special train (C.P.R.) for Radnor Forges, Que., where a visit will be made to the improved furnace plant recently built by the Canadian Iron Furnace Co. (Ltd). Visitors will be the guests of the Company. There will also be a drive on Lac-a-la Tortue, visiting the curious bog-ore deposits worked by the company, and other features of interest in the vicinity.

The syllabus of papers is large and representative. Among those who have promised to contribute may be mentioned:—*Nova Scotia:* H. S. Poole, F.G.S., A.R.S.M., Stellarton; C. Fergie, M.E., Westville; John Rutherford, ex-Inspector of Mines, Stellarton; John E. Hardman, Oldham, N.S.; Dr. E. Gilpin, Halifax, and others. The various features of the Mining Law of the province will be discussed by Messrs. Geo. Stuart, B. C. Wilson, John Hardman, C. Archibald, J. R. Lithgow, R. G. Leckie, R. H. Brown, H. S. Poole, and others. *New Brunswick*:—Mr. W. McInnes, of the Geological Survey, will read a paper on the Mineral Resources of the Province. *Quebec*:—Dr. R. W. Ells, Ottawa; A. P. Low, Ottawa; J. Burley Smith, Glen Almond, Que.; P. H. Griffin, Buffalo; Prof. B. J. Harrington, Montreal; J. Obalski, M.E., Quebec; Dr. W. T. Gibbs, Buckingham; J. T. Donald, M.A., Montreal, and others. *Ontario*:—W. Hamilton Merritt, M.E., C. G. Richardson. Toronto; J. Bawden, Kingston; T. D. Ledyard, Toronto; George Mickle, Sudbury, and A. Blue, Director of Mines, Toronto. *British Columbia*:—J. McEvoy, Ottawa; George Atwood, M.E., F.G.S, Vernon, and Capt. R. C. Adams, Montreal.

Mr. R. G. E. Leckie, manager of the Torbrooke Iron Company, desires to correct a statement that the Clementsport iron ores are high in sulphur and iron. Since his paper was published in the REVIEW he finds from various analyses that, in some of the properties at least, the ores are very low in these deleterious constitutents.

The troubles in the Foord pit, owned by the Acadia Coal Company at. Stellarton, N.S., have again become public. Lost in 1880 by explosion and fire, it remained untouched until 1886, when the work of unwatering began. This accomplished, after many difficulties, in 1890, brought out from England an expert selected by the English Directors of the Company to develop and equip it. Familiar with underground fires and broken ground, he did not hesitate to promise success under his management. A free expenditure followed. A "fire-stink" declared to be but local spontaneous combusion, though venal ignorant natives did suggest that the fire from "the rise" had travelled with the water towards the deep. Time went on; no evidence of fire was seen, and confidence begetting confidence expenditures went on. Not entirely though was suspicion allayed. "A burnt child dreads the fire," and many miners shook their heads; it was even said the management were not unanimous. With November came the "fire-stink" in a new quarter—another spot of spontaneous combustion, it was said. Whether or no, it soon showed near the pit bottom, and then it was evident the pit must be closed for a time at any rate. This was done and water allowed to rise.

The Kingston Mining Company, East Templeton District Phosphate Mining Syndicate, McLaurin Phosphate Mining Syndicate, Foxton Phosphate Mining Company, The Phosphate Mining and Shipping Company, and other properties controlled by the syndicate represented in this country by Messrs. Lomer, Rohr & Co., Montreal, are now being amalgamated under the management of one concern. We hope to give particulars of the new arrangement in a future issue.

Rumor hath it that Mr. William Mackintosh, of Buckingham, has been appointed a Mining Inspector for the Eastern Townships. The REVIEW cannot congratulate the Government on the appointment. This gentleman may possess a certain amount of knowledge and experience in the quarrying of phosphates, but we have yet to learn that he comes up to the standard of the Act which enjoins (section 1513) that "Inspectors must be *mining engineers* possessing sufficient knowledge of mineralogy and metallurgy." The miners of Quebec insist upon the appointment of thoroughly qualified engineers to supervise their operations.

Owing to a much depressed market the ocean shipments of Canadian phosphates during the past season have been the lowest for many a year. Returns show an export of:—

	Tons.
To Liverpool	3,642
London	1,573
Other British ports	1,690
Hamburg	1,636
Total European export	8,541

The shipments have been distributed as follows:—

	Tons.
O. M. Harris	3,937
Lomer & Co	2,249
Wilson & Green	1,942
Capt. R. C. Adams	413
	8,541

Towards the end of the season a fairly good market developed for the lower grades in the United States, and about two thousand tons of ground have been forwarded to Buffalo, Chicago and Detroit. Messrs. Lomer, Rohr & Co. at date of writing, have still important shipments to make. A few hundred tons of ground have been used by the chemical works at London, Ont., and at the superphosphate works at Smith's Falls and Capelton. Advices from Europe are hopeful of an improvement in prices before next year's shipping begins.

The value of the exports of minerals from the port of Ottawa for the past eleven months is:—

Ground Phosphate	$10,791 30
Asbestos	800 00
Iron ore (Bristol mines)	16,846 50

"The London Mica Importers, Limited," is the designation of a new syndicate just formed in London, England, with a capital of £70,000, to purchase mica properties and deal generally in the mica business.

At a public meeting held in Kingston, Ont., on 8th instant, subscriptions amounting to $13,800 were announced for the establishment of a School of Mining and Agriculture in that city.

Judge Malhoit has delivered judgment in a case, at Aylmer, which declares the tax in Quebec imposed by the Government of 1½ per cent. on all sales of properties illegal. The case arose out of the sale of the Brock mica mine to T. P. Coffee, a solicitor in Guelph. Mr. Sims, an agent of the Quebec Government, took action against Mr. Coffee for the amount of the tax on the price of the property. It is likely that an appeal will be taken against the judgment.

The following table gives the shipments of petroleum (crude, refined and crude equivalent) from the Petrolia district, Ont., for the first eleven months of 1891 and 1892 :—

	1891			1892		
	Crude.	Ref'd.	Crude. Equiv.	Crude.	Ref'd.	Crude. Equiv.
January	19,910	20,974	70,749	17,441	24,751	79,218
February	14,577	18,073	59,759	16,341	23,993	76,324
March	15,517	16,227	56,084	16,570	19,469	65,217
April	16,615	15,665	52,850	12,542	15,145	51,704
May	17,077	15,071	56,754	15,045	8.665	61,897
June	15,071	15,547	53,885	15,225	17,510	58,000
July	15,715	16,308	56,484	13,289	19,562	62,193
August	15,296	26,910	82,570	15,370	28,077	85,562
September	20,329	35,720	109,629	17,264	39,736	117,605
October	21,627	39,632	120,710	220,507	44,010	130,542
November	18,966	26,898	86,211	21,787	39,005	129,299

An Ontario correspondent writes : Have you noticed how much money the Ontario Government is squandering upon the Chicago Exhibit. Some $16,000 were voted to defray all expenses, and this amount distributed among some eight other departments in amounts ranging from $1,600 to $2,000 for each. The result is that the whole exhibit has been collected (mainly through private means) from a few districts of the Province, leaving others such as Temiscamingue, Wahnapitæ, Georgian Bay, North Shore of Lake Superior (except a few samples of building stone there are nothing from the latter.) Sudbury is represented by copper, nickel and some platinum sand, but no gold. The Commissioner informed me (pointing to some samples of marble), "These are from Senator Sandford's marble quarry. They cost us (the Government) $250 to get out and polish. At the same time the Government would not pay such a man as Peter Mackellar his expenses incurred in making a collection from the Port Arthur district, the exhibit from that section being obtained as a personal favor to the gentleman, who is at present engaged in arranging and cataloguing the exhibit. Perhaps you can do something."

On enquiry we find that the statement of our correspondent anent the appropriation is very misleading, as a number of Departments to be represented have not as yet called for more than a trifling expenditure.

We are informed by the Commissioner, Mr. Awrey, that fully one-third of the amount so far expended has been for the collection of minerals. Of course, the $16,000 was only a preliminary vote, and it will necessarily be supplemented by a much larger one. The collection of minerals is yet by no means complete, and samples are being received daily. The complaint of the inadequate representation of the northern country will not be justified by the facts, except perhaps in so far as the Temiscamingue and Wahnapitæ districts are concerned. The mineral value of these districts is practically unknown, and the only way by which samples could be obtained would be by exploring for them, which the Government could hardly be expected to do. There are, however, some samples of gold from Wahnapitæ, and more are looked for.

As to the representation from the north shore of Georgian Bay, our correspondent is very much mistaken, for we are informed, in addition to the very large collection of minerals from that district, including gold, nickel, copper and iron ores, large lots will be shipped direct. Among these latter are three and a half tons of copper-nickel ore from the Stobie mine, six tons from the Evans, and three from Copper Cliff, each sample in the mass ; besides a trophy of matte of 6,000 pounds and a pyramid of refined nickel weighing 3,500 pounds. There will be in addition specimens in all stages of production, from the raw ore to the refined metals. These will be exhibited in six fine cases nickel-plated with nickel taken from the mines. Half a ton of gold ore is promised from the Ophir mine in Galbraith Township, a large exhibit of rich native copper from Point Mamainse, and many other specimens which need not be enumerated.

The Lake Superior region is represented by a very choice collection which has been placed at the disposal of the Commissioner by Messrs. Wylie & Co. of Port Arthur. It was not possible to obtain samples from the mines, owing to the fact that these are now closed and all ores shipped. Mr. Awrey tells us that the reference to Mr. McKellar is altogether untrue, as there was no question of remuneration or expenses; the only reason why Mr. McKellar was not employed being his own statement that the mines were closed down.

A letter from Mr Boyle, the gentleman referred to in latter portion of our correspondent's complaint, disclaims any credit for the exhibit obtained from the Port Arthur district, and from information received from other sources we believe that this statement is strictly true. At the same time we do not see any reason why the Commissioner should hesitate to take a collection coming from any source, through any person's influence, if obtained in an honest and honorable way.

With reference to the Barrie marbles, Mr. Awrey states that five quarries are represented in this collection, and that the total cost was nothing like the sum stated by our correspondent. It may occasionally happen that an exhibit costs more than it should, owing to the peculiar circumstances, but any one who has had experience in the making of a collection will have the sense to allow for such cases.

While by no means favorable to the disposition of Canada's exhibits by Provinces, Dr. Selwyn, Director of the Geological Survey, expresses himself as much pleased with the excellence and thoroughness of the mineral collection to be sent by Ontario to the World's Fair.

Mr. F. J. V. Skiff, Chief of the Division of Mines and Mining, contributes, in a recent article, an interesting outline of the plan of the great mining exhibit at the World's Fair. The subject of coal will be treated on very broad lines. It would be impossible to accept for exhibition purposes all the really meritorious specimens of coal that can be secured, for the purpose of demonstrating the resources of the country in this great fuel. The treatment must be comprehensive and sweeping, and the display based upon the distribution of the great coal fields that stand out prominently in the geology of the country. The coal industry is of gigantic proportions, involving the investment of many millions of dollars and the employment of hundreds of thousands of people. The display of coal at the Exposition will be qualitative rather than quantitative. The different varieties of coal produced by the different localities will be shown, together with the chemical analysis of each, and the results of tests determining economic value and adaptability to various uses. The coal resources of countries, states and sections will be shown by geological maps and drawings, exhibiting the stratification, cross-section, etc., which will render apparent the extent and accessibility of the vast number of coal beds and veins which underlie the earth's surface. In the mining machinery section will be shown every species of apparatus, simple and complex, employed in working a mine from the lowest drift to the dump. Methods of timbering, ventilating and lighting the various slopes, levels and galleries will be shown by examples. Trams, hoists and automatic dumps, engines for pumping, rock-breakers, screens, grizzlies and other sizing appliances will attract the inspection of the visitor and instruct in the greatest of all industries. Improved diamond drills and contrivances for loading and unloading ores and for their storage, automatic stevedores for transference on the surface, patent self-emptying cars, wire ropeways with their outfits of buckets, etc., coal tipples, steam shovels, belt conveyors, etc., etc., will complete the methods by which the stupendous mining operations of the present age are conducted. For the purpose of practical study, the division of history and literature of mining and metallurgy will be unsurpassed. To this end college faculties and professional men are already pledged. Every facility will be afforded for examining in detail the geology and distribution of minerals and ore-bearing rock. The rich literary stores, maps, models, etc., of the leading educational institutions of the land will present to the student who visits this great repository at the Columbian Exposition an unexampled opportunity for considering the entire subject of historical and statisical mining. Mine engineering will be adequately represented by surveys and plottings, by projections of under-

ground work and models, and by literature descriptive of the methods of running shafts, tunnels, construction of mine workings and the handling of ores. An elaborate and accurate reproduction of the ancient and unique mining and metallurgical methods, appliances, tools and processes as illustrating the evolutions in the industry, will attract the attention of all classes, and teach fruitful lessons in the advance of science, invention and general civilization. When the exhibits in the department of mines, mining and metallurgy shall have been properly collected, classified and arranged, the department will be a comprehensive and complete exposition of all the great mineral treasures of the earth, and the methods employed in their search, their treatment and their usage.

Referring to the accident on 7th instant at the Drummond colliery, Mr. C. Fergie, M.E., manager of the Company, writes, under date of 15th instant:—

"In addition I may say we last night completed a second dam some 232 feet outside of the first, which will hermetically seal the tunnel and remove beyond doubt the existence of fire. That roburite fired the shot there is not the slightest doubt; the shot hole was some 30 feet long and well prepared and stemmed, which is proven by the shot doing its work. The detonator was properly imbedded in the explosive mixture, and the whole was fired by electricity; in fact everything was done as per instructions given by the manufacturers, and a man having considerable experience with the use of the explosive fired the shot. The manager and men have hitherto had the greatest confidence in roburite; it is, however, needless to say that that confidence is now shaken, and the manager will be most careful in future as to where he introduces it.

"I am sorry I have not now time to write you a more detailed description of the affair, but I am preparing a lot of facts in connection with it and will let you have them with a section of the tunnel showing dam. I am sending samples of the roburite away to-day for analysis."

Until more information is available it would be unwise to wholly condemn roburite as an unsafe explosive in collieries. The Explosives Commission advised the same caution respecting its use as the law required in the case of black powder. In this instance, it is stated that one shot-firer declined to explode the shot which his successor on the next shift did fire, and as the firing was attended by a small explosion, it is clear there was some gas present; there was no dust about, the tunnel being damp. We are satisfied that while roburite is not absolutely safe under all circumstances, it is much safer than black powder.

The Bethlehem Iron Company has recently been investigating the qualities of nickel steel with the object of ascertaining whether it might not prove valuable as a material for certain parts of machinery. The results have not yet been made public, being in the possession of Commodore Welville, engineer in chief of the U. S, Navy. The carbon steel generally employed for propeller shafts has a tensile strength of 65,000 pounds, and an elongation of 20 per cent. Nickel steel has a tensile strength of 90,000 pounds, with the same elongation. It has now been decided to make a section of the propeller shafting of the Brooklyn and the seagoing battleship No. 1, of nickel steel in order to test, on a practical working scale, whether it really has the advantages that it promises. The shafting of the two materials will be of the same diameter, and a hole will be bored through the nickel steel shaft with a view to equalizing the strength of the two, while the weight of the nickel steel will be less, this being a very important factor in .all marine machinery. It is also proposed to try nickel steel for boiler plate.

A new firedamp detector has been devised by M. Chesnau, secretary of the French Firedamp Company, which will indicate proportions of gas in the air as low as 0·1 per cent. The apparatus takes the form of a safety lamp, in which alcohol is burnt, and the difference in brightness between the halo or ring due to the fuel and the alcohol flame is rendered more perceptible by the addition to the alcohol of a small quantity of chloride of copper, which tinges the flame with green, while it gives the rings a greenish-blue colour. In point of security the indicator is said to be on a par with the best safety lamps.

The question of lighting coal mines is one which has for many years received the attention of experts, and the number of patents that have been taken out for lamps of every description is one of the best indications that many are engaged in trying to solve the difficult problem. One of the first of what may be called the modern type of lamp is the Wolff, which is used in some of the continental mines, and has many advocates, although, in this country, the use of benzine as a luminant will never be acceptable. The next lamp that has gained considerable favour among miners is the "Thornebury." In this lamp only heavy mineral oils are used, and it has the advantage of combining strength and lightness with good light-giving powers. The tests made with this lamp under the direction of Sir Frederick Abel are said to have been highly satisfactory, the light being above the average, and when placed in position where dangerous gases prevailed their presence was at once noted by the change in the flame. With the advance made in the manufacture of secondary batteries, the construction of an electrical miner's lamp became possible, and from the cumbersome affair that was devised by Swan some ten years ago a great change has been wrought, and there are several now in the market that have many points to commend them. Among others we may mention the "Stella" lamp, which weighs only three and one-half pounds, and is capable of giving seven-tenths of a candle-light for twelve hours. The Bréquet lamp, weighing nearly six and one-half pounds, gives one candle power for eighteen to twenty hours, and the "Bristol," weighing five and one-quarter pounds, one candle power for eight to ten hours. The one great difficulty in connection with electric mining lamps is the unreliability of the lead plates of the accumulators, which, in time, warp, and become short circuited. This trouble, however, should not be very difficult to overcome, as it means that the plates must be specially arranged so as to prevent the warping and contact. The experience with electric lamps has not been very satisfactory. It was found that owing to the corrosion of the connections they became practically useless after about six months at work. The fact that the electric lamp does not indicate the presence of dangerous gases or inflammable vapour should not be reckoned against its use, for it would be far better to have in each working one or more of the Clowse detector lamps by which the amount of dangerous vapour could be noted from time to time, than to depend upon the miner whose attention is directed to his work more than to testing for gas. One or two men could constantly visit the lamps, and, if necessary, warn the men that the mine was dangerous. There are many lamps that will detect large amounts of fire damp, but for quantities below two per cent. a special arrangement is necessary, and the person making the test must understand his business thoroughly, for, if dust is present when even a small percentage of fire damp is indicated, the danger is almost as great as if the gas was present in larger quantities. It should not be difficult to arrange the accumulators for the miner's lamps in the shape of a small knapsack, and lead the wires to the cap, where a small lens could be fixed to throw the light directly upon the work. By this means the trouble of handling the lamp would be avoided, and the weight so distributed that it would not be felt.

In a paper on the subject of wear and tear of steam boilers due to expansion and contraction strains, before the Midland Institute of Mining, Civil and Mechanical Engineers, Mr. J. Clark Jefferson referred to the connection between rise of temperature, the linear expansion or contraction thereby produced, and the reserve force which is brought into play when either of the latter is opposed by excessive rigidity of construction. The elongation or contraction was given as $\frac{1}{144000}$th of the original length per degree Fahrenheit, and as representing a reserve force of 208 lb. per square inch of section per 1 degree Fahrenheit rise or fall of temperature, or in the case of an ordinary Lancashire boiler, a reserve thrust on the ends of the boiler of 340 tons under ordinary working conditions. The mode in which this thrust causes grooving in the end plates over the flue angle irons was explained in detail and illustrated by drawings; as also the manner in which differential expansion at lap seam joints caused leakage at and between the rivet holes in internal flues. The differential expansion in the lap circular seams in the mid and side flues, and, in the case of externally-fired boilers, was shown to produce a movement of the outer lap away from the inner lap at least eighty times the longitudinal expansion of the rivet, and this explained the liability of externally-fired boilers to leak in the lap seams directly exposed to the fire. The transmission of heat from the fireside to the water depended mainly on the surface conductivity of the plates, the internal resistance being comparatively negligible when compared with the surface resistance, and hence the advisability of having

all joints near to the fire-water covered. The expansion of the firebox in the case of vertical and locomotive boilers caused grooving in the outer plates analogous to the grooving in the end plates of Lancashire boilers. The proper direction in which the draught should be carried round the flues was described, that for Lancashire boilers from the internal flues to the mid-flue, and then split to return down the sides, whilst the contrary direction along the side flues and to return by the mid-flue for Cornish boilers was recommended as most advisable. The defects produced by an opposite course, especially where the attempt was made to get up steam rapidly, were pointed out. The molecular deterioration of the plate of fireboxes, which were the most severely tried parts of a boiler, was also referred to, and the paper concluded by drawing attention to the above defects as showing the importance of keeping the working temperature at any part of a boiler uniform for that part, and of raising or lowering the temperature as gradually as possible.

A late despatch announces the termination of the strike at Springhill.

Professor Ahn.

(Written for the CANADIAN MINING REVIEW, by Stephen H. Emmens, Youngwood, Pa.)

In adopting the above title for this article I am not conscious of doing anything unjustified by fact or more severe than the circumstances of the case call for. I may even add that I do not feel unkindly towards the Professor, and that I regard him as a product of hard fate rather than of any inherent depravity. If, in the future, I can do him any good turn I shall not be indisposed to do so; but just at present the good of the mining community is uppermost in my mind.

I first made the Professor's acquaintance in October, 1891. He was introduced to me by the officials of the Imperial Trusts Company of Canada at their Toronto office. He stated that he controlled a mine, (Lot 12 of the 3rd concession of Denison Township, in the Algoma mining district) where a brilliant discovery of gersdorffite had been made and which was virtually sold to some Rochester (N.Y.) parties. He volunteered to accompany me to Sudbury and show me that famous nickel district, concerning which he impressed me with the belief that his knowledge was, like Sam Weller's of London, "extensive and peculiar." I thankfully accepted his offer and found him an agreeable and useful travelling companion, very courteous, very good-humoured and fairly well posted as to the Sudbury mines and doings; though a little conversation soon showed that his claim to be an expert was founded upon a peculiar rather than extensive knowledge of chemistry, mineralogy, metallurgy and mining. Altogether I considered him superior to and somewhat more truthful than the ordinary run of claim-sellers in new mining districts. He did not, however, attempt to sell me any claim, and did not show me the gersdorffite discovery, but contented himself with accompanying me about, and even braved the redoubtable Mr. Merry, senior, at the Murray mine, on my behalf—a feat of no mean order, as the Sudbury world well knows. When I was afterwards told that the choleric old gentleman in question has an amiable weakness for jumping on his hat, when troubled by the cares of life, and when I remembered that I had innocently replied "I am a nickel refiner taking notes" to his question of "who are you, and what the devil are you doing here?" (N. B.—I had made proper application at the mine-office and had received permission to visit the works.) I shuddered at my narrow escape; for, incredible as the story may appear, the Professor and I were allowed to go intact from the Murray Mine.

The Professor returned with me to Toronto where we parted; and I have not seen him since.

On January 11 of this year he wrote saying that his sale of the Gersdorffite property was "an accomplished fact and we start to work on or before the 20th inst." He sent me some samples of ore and wished to arrange for selling the output of the mine to the Emmens Metal Co. Among the samples was one thus described "No. 3, a piece of Millerite and Perryhotite (*sic*) as found on either side of the vein of Gersdrophite (*sic*)."

On February 6th he wrote me saying that his deal had fallen through and inviting me to take up the mine. In this letter he stated his belief that the mine was "a finer and richer property than the Worthington," and added "I have so much confidance (*sic*) in this property that I would undertake to mine and deliver ore without any charge for my services until satisfactory results were obtained or would undertake to work it, participating in the profits made for my services, with a capital of $5000 I do not hesitate to say I could take hold of this property and purchase it from the proceeds of the ore mined without any outlay by the parties investing." To this letter I replied on February 15th saying, "I think it will be worth while for you to send me your reports and plans relative to the Gersdorffite mine; as, if the details be satisfactory and if a common-sense bargain can be struck I am disposed to work the property." I then added that I had just received a letter from an English mining expert who wrote "I did not think very much of Sudbury, and on my return to England I advised my people not to complete their purchase of some Ni., mines on which they had an option as the samples I took myself were very low in Ni., and I considered cost of manufacture would be high;" and I went on to say, "This incident is but one more added to those I have not noted in mining matters during the last twenty-five years, and which have taught me to attach no practical importance to *samples*, unless, indeed, they be fairly taken from large parcels of ore. I should no more think of buying or working a mine on the faith of a sample than I should of buying or renting a house on the faith of a brick, In the Sudbury district especially is this caution indispensable. The quantity of ore there existing is, in the aggregate, very considerable; but the surface indications of any individual deposit are not to be relied upon. *Development* alone can determine whether the deposit is or is not of a character to justify the sinking of capital. Hence you will understand that the only proposition I should consider acceptable would be one based upon development."

On the same date I also wrotc to the Professor as follows: "Referring to my separate letter about the Gersdorffite mine I may explain that in the event of my finding your report satisfactory and a lease being entered into as suggested, I shall be willing, if you so wish, to entrust the working of the mine to yourself on contract, at the price of $5 per ton for ore placed on cars on the C.P.R. This should leave you a very considerable profit, sufficient not only to represent good renumeration for your services, but also to enable you to accumulate capital out of the working of the mine."

On March 4th the Professor sent me his report and wrote: "As regards your propisition to place the working of the mine in my hands at the price you name, this would be perfectly satisfactory to me and I would undertake to do same, receiving payment on the cars being weighed in Sudbury."

The principal passage in the report was as follows: "This property is situated north-west (*sic*) of the Worthington mine, the second richest in the district, and is distant but one mile, the same lode which starts at the Worthington is clearly traced right into the Gersdorph (*sic*) property, where the ridge carrying the deposit seems to culminate in the largest body of mineral, and it is at the north-easterly extremity of this ridge where the mineral was first discovered and where developments have shown a rich and extensive body of ore to exist together with what appears to be a true vein of the mineral Gersdoffite (*sic*) and Nickelite (*sic*) samples of which have been assayed as high as 63%, the assays being made by the Geological Department of the Dominion Government at Ottawa. This is the only mine so far that has exhibited nickel in these forms and the only one in the district that exhibits anything in the way of a vein of nickel—in this opinion I am borne out by Mr. A. E. Barlow, M.A., of the Geological Department. The vein matter starts at the surface about six (6) inches wide, but rapidly and steadily widens to about thirty inches at a depth of eight (8) feet where it enters into the side of the shaft, which is sunk to a depth of eighteen (18) feet on the side of the hill. The vein is cutting this hill at an angle of about forty-five (45). *The hill in question is almost a solid body of Millerite, Nickeliferous Pyrrhotite and Chalcopyrite all of a high grade as has been shown by assays made by Sperry and others.*"

The result of these representations was that the secretary of the Emmens Metal Company finally met the Professor in Toronto and two agreements were entered into, one with the owners of the mine for a working option, and the other with the Professor whereby he undertook to work the mine in accordance with the option, receiving from the Emmens Metal Company, $5 per ton for all ore placed on cars, an advance being made to him at the outset (against ore to be afterwards delivered) to enable him to prepare a road and erect a shanty for sheltering the miners.

Work then commenced but it soon became evident that no speedy supplies of ore would be forthcoming, and on June 16th I wrote to the Professor indicating the disappointing features of the situation and stating that the Company would probably not care to continue the matter without some radical change in the terms of the option. To this the Professor replied on June 18th in a letter from which I will quote the following passage:

"There is a body of Nickeliferous ore on the surface though, according to your tests, not as high-grade as I was led to believe from a number of assays made by other assayers, copies of which are embodied in my report, that this surface deposit is not so extensive as I at first supposed, is but one of the contingencies of mining, but while this has to some extent diminished yet the high grade ore has exceeded my anticipations, when speaking of high grade ore I mean the Gersdorffite and Nickelolitc (*sic*), and of this ore I consider it possible to mine enough to pay the expenses of the development."

This deliberate statement was made after practical development had continued for some time and after the receipt of various cautionary letters from myself. It was a hard thing to regard a statement made under such circumstances as being untrue or to regard the Professor as an ignoramus, incapable of forming a correct judgment. Accordingly after consultation with the secretary of the Emmens Metal Company I wrote to the Professor on June 23rd as follows:

"Mr. Landale is here, and we have carefully considered your letter of the 18th inst. We have decided to rely upon your deliberate expression of opinion that, with reference to Gersdorffite and Niccolite, you consider it possible to mine enough to pay the expenses of the development, by which we understand you to mean that we may reasonably expect to receive by August 31st, sufficient high grade ore to amount, at $5 per ton, to the total of our advances. Upon this understanding we forward herewith a cheque for $400 as an advance on account of ores to be shipped at the rate of $5 per ton, or else to be taken over by us on the mine at $3 per ton. Please therefore sign and return the enclosed form of receipt. In view of this decision, I do not think it necessary to enter upon any technical discussion in reply to your letter. I will merely say that in acting on your advice *we entrust our interests to your professional ability and good faith.*"

The Professor signed and returned the receipt without a word to qualify or modify the understanding on which the $400 was advanced. Yet at that time (June 25th) the condition of the mine was such as to preclude any reasonable expectation of the promised ore being produced during the next two months. This will be evident upon a consideration of the following passages from a report made on August 13th to the Emmens Metal Company by Messrs. Rickett and Banks, of New York, who were engaged to inspect the mine:—

"The surface of the Greenstone dyke has been stripped at several places on the property, and an inclined shaft sunk 37 feet at an angle of about 45 degrees to the southeast, upon a mineral vein in the diorite near the southeast contact of the dyke, which latter having a steeper dip southeast is cut diagonally by the vein. The ore lens has a nearly parallel trend to that of the dyke. The seam or vein of ore at the collar of the shaft is about six inches thick, it pinches to about three inches at the depth of 20 feet, and then gradually thickens to the bottom of the shaft, where on the south-west side it is 13 inches thick. The vein filling is largely a changed diorite with some little quartz and feldspar, carrying several irregular seams and scattered bunches of chalcopyrite and pyrrhotite with admixture of nickel minerals. In the bottom of the shaft in the north-east side the seam has pinched to about an inch." [N.B. This is the vein of which the Professor reported, "The vein-matter starts at the surface, about six (6) inches wide, but rapidly and steadily widens to about thirty inches at a depth of eight (8) feet, where it enters into the side of the shaft which is sunk to a depth of eighteen (18) feet."]

"There was at the mine in barrels and in piles on surface sufficient materials from which to select, say, ten tons of ore for shipment. Ore in sight cannot be estimated owing to the very irregular distribution of the sulphurets and limited development work."

On reading this report I wrote to Messrs. Ricketts and Banks asking them various questions, among which were the following:—

1. "Mr. Ahn says, speaking of the ridge in which the shaft on the vein is sunk, 'The hill in question is almost a solid body of Millerite, Nickeliferous Pyrrhotite and Chalcopyrite, and of a high grade.' Is this statement true, or is it a preposterous lie?"

The reply made by Messrs. Ricketts and Banks to this question was, "We think the statement is not verified by existing developments."

2. "Does a true vein of Gersdorffite and Niccolite exist?"

The reply made by Messrs. Ricketts and Banks to this question was, "The vein cannot be called a vein of Gersdorffite and Niceolite."

It is hardly necessary to add that on receiving the report from Messrs. Ricketts and Banks, the Emmens Metal Company threw up their option of acquiring "the hill of solid Millerite, nickeliferous Pyrrhotite and Chalcopyrite, all of a high grade."

A Large Coal Breaker.—The Lehigh and Wilkesbarre Coal Company has broken ground at Ashley, Luzerne county, Pa., for the largest breaker in the United States. One year ago the company began sinking the Maxwell shaft, and this breaker will be used to prepare the coal from it for market. The shaft, like the breaker, is said to be the largest in the world. It is 13 by 54, and 4 carriages will be used to hoist coal from the 2 immense veins—the Baltimore, 640 feet deep, and the Red Ash 940 feet deep—which it will tap.

The new breaker will be 127x150, and will have a capacity of 3000 tons per day. It is located 1000 yards from the foot of the Jersey Central planes, over which all coal mined in the valley and shipped over this road passes on its way to city markets, so that a vast sum will be saved annually in the matter of transportation. The works will necessitate an expenditure of $250,000 before a ton of coal can be despatched to market from it, and will furnish employment to 2000 men and boys.

Quarterly General Meeting of the Mining Society of Nova Scotia.

The December Quarterly Meeting of the Mining Society of Nova Scotia was held in the rooms of the Society at Halifax, Thursday, 8th instant. Proceedings commenced at ten in the forenoon. Mr. H. S. Poole, F.G.S., A.R.S.M., President, in the chair. There were present: John E. Hardman, S. B. Oldham, R. G. Leckie, M.E., Londonderry Iron Co., Londonderry; George W. Stuart, Truro Gold Mining Co., Truro; Duncan McDonald, Truro Foundry and Machine Co., Truro; James Baird, Canada Coal and Railway Co., Maccan; Wm. Smaill, Londonderry Iron Co., Londonderry; Charles Archibald, Gowrie Coal Co., Cow Bay, C.B.; R. H. Brown, General Mining Association, Sydney Mines; J. R. Lithgow and Wm. Lithgow, Glace Bay Mining Co., Halifax; Dr. E. Gilpin, Jr., Inspector of Mines, Halifax; J. M. Reid, Oxford Gold Mines, Musquodoboit; C. E. Willis, Halifax; G. J. Partington, Whiteburn; Howard Clarke, the *Critic*, Halifax; B. C. Wilson, Waverley; J. H. Austen, Halifax; F. Taylor, Lowell, Mass.; Capt. George McDuff, Waverley; T. R. Gue, Halifax; G. E. Francklyn, General Mining Association, Halifax; W. H. Huggins, Halifax, and H. M. Wylde, Secretary.

The Secretary read the minutes of the previous meeting which were confirmed. The rules of the Society being suspended the following were duly elected to membership: —. Thomas, Montague Mines, proposed by Capt. McDuff, seconded by T. R. Gue; John S. Kennedy, Ferrona, N.S., proposed by Wm. Smaill, seconded by H. M. Wylde. Associate members:—James Purvis, Cape Breton, and Geofirey Morrow, Halifax, proposed by R. G. Leckie, seconded by Charles Archibald.

THE MONTREAL CONVENTION.

THE SECRETARY read correspondence from Mr. B. T. A. Bell, Secretary General Mining Association of Quebec, with reference to the International Mining Convention and meeting of the American Institute of Mining Engineers to be held in Montreal during the week commencing 21st February, 1893.

THE PRESIDENT—Mr. C. Fergie, M.E., is preparing a paper describing the methods of mining at the Drummond Colliery; also Mr. B. C. Wilson, on the subject of leasing gold properties in Nova Scotia.

MR. JOHN E. HARDMAN—Has it been determined whether we shall attend this Convention officially or only as individuals, in other words is the Mining Society going to send delegates to represent the Society, or are we going simply as individuals.

THE SECRETARY—This question has been considered by the Council and referred by it to this regular meeting.

MR. T. R. GUE—I believe that nearly every member intends going to Montreal, and I suggest that perhaps this society should have a special meeting there. We could have a better meeting in Montreal at that time than we could have here, and I am strongly in favor of a special session of this Society during the convention. If the meeting is well attended we may conclude to dispense with the next Quarterly General Meeting. I, personally, would like to go very much, and most all of the members have expressed their willingness to attend on that occasion.

MR. JOHN HARDMAN—Such a meeting as proposed by Mr. Gue would come under the third paragraph of the fifth section of the By-Laws. It could very easily be convened as a special meeting.

On motion it was voted to hold a special meeting of the Society in Montreal during the third week in February.

THE PRESIDENT said he had no doubt that the papers which would be prepared by the members of the Society would be of a character which would reflect credit not only upon the members, but also upon the Society.

DR. E. GILPIN—Would papers be read at the meeting of the Society or before the Convention?

THE SECRETARY—The Convention.

The following subjects on legislation in Nova Scotia were allocated for papers and discussion at the Convention.

(*a*) That portion of the Mines and Minerals Act relating to gold, by Messrs. Stuart, Wilson and Hardman.

(*b*) That portion of the Act relating to mines other than gold, by Messrs. C. Archibald and J. R. Lithgow.

(*c*) The Mines Regulation Act, by Messrs. R. G. Leckie, R. H. Brown and H. S. Poole.

MR. R. G. LECKIE, referring to the suggestion contained in Mr. Bell's letter that an excursion might be made during the Convention to Nova Scotia, said he thought the time of the year most unfavorable. It was the very worst period to visit the province and to examine its varied and excellent resources. He therefore moved: "That while acknowledging with pleasure the interest entertained by the General Mining Association of the Province of Quebec in the mining industries of this Province, and also expressing our most cordial desire to entertain the American Institute of Mining Engineers in Nova Scotia at a suitable and convenient season of the year, be it resolved: That in the opinion of the members of this Society the month of February would be a most unfavorable season to view the varied resources of this Province, and also that the difficulties and uncertainties of travel are great at that period of the year: Further that the representatives of this Society to the Montreal Convention be and are hereby requested to consult with the officials of the American Institute of Mining Engineers with a view to holding an autumn meeting here next year (1893)."

MR. JOHN HARDMAN, in seconding the resolution, said he could not add anything to what Mr. Leckie had said. At that season of the year we would not be likely to get representative mining men and capitalists to visit the Province, particularly after a protracted session in Montreal.

DR. GILPIN said he had had something to do with the autumn part of the last excursion in 1885 of the American Institute to Cape Breton. He remembered two stormy days when they had the greatest difficulty in preventing the excursionists from taking the next train home. He thought the Institute should visit Nova Scotia at a time of the year not later than the middle of September.

The resolution carried.

The Secretary was instructed to send a copy of the resolution to Mr. Bell and also to Dr. Raymond.

THE PRESIDENT invited discussion on the papers read at previous meetings.

DISCUSSION ON MR. POOLE'S PAPER, "NEW EXPLOSIVES FOR COAL GETTING IN NOVA SCOTIA."

MR. T. R. GUE—I am preparing a paper for a future meeting fully criticising Mr. Poole's paper.

DR. E. GILPIN—The Explosives Committee is to meet again and prepare a final report. Parties who had tendered one explosive claimed that they had since introduced a slight improvement. We have a small supply of ammonite. Perhaps Mr. Brown could tell us how he succeeds with this explosive at his mine.

MR. R. H. BROWN—We tried ammonite for a short time, but our men were prejudiced against it and would not give it a fair trial. We fired a few shots and it acted the same as roburite. It seemed to blow out two or three cubic feet and would not bring the shot down. The cartridges are made in metallic cases and you cannot alter them in diameter or length.

DR. E. GILPIN—I do not think any of the new explosives introduced on the continent are better. They have some new explosives in France and Germany which I suppose we cannot get here. So far as I know the roburite and other powders have worked fairly well. I believe that there were one or two cases of sparking—I think one in the Acadia Company—but as far as I can see in the literature on the subject I do not see anything better. The question which I think is important before the Commission, although it is a little on one side, is that in regard to detonators. I see they have been using the compressed detonator, which seems to be safer in its action.

THE PRESIDENT—Broadly speaking, you are of the opinion that the so-called flameless explosives tried in Nova Scotia are much safer than common powder for work in mines where gas is produced?

DR. GILPIN—There is no question about that.

DISCUSSION ON MR. HARDMAN'S PAPER, "RECENT GOLD MILLING PRACTICE IN NOVA SCOTIA."

THE PRESIDENT called on Capt. G. McDuff for some remarks on Mr. Hardman's paper.

CAPT. McDUFF—I think the paper a very good one, and I do not see how it could be improved on. The only point I can question is the extremely low costs given.

MR. JOHN HARDMAN—I came here cocked and primed with explosives, one pocket full of dynamite and the other full of roburite, and with seven-fold exploders in my vest pocket, prepared to defend my paper, but as no criticism is forthcoming I fear the ammunition will have to be thrown away. Since I wrote that paper we have had considerable experience in the "Waverley Mill." In regard to costs, the cost of running the Oldham Mill was very low because water power was used, but there will not be so very much more difference in a steam mill. The percentage of gold recovered was just as favourable running the Waverley Mill at about 100 drops per minute, as in the Oldham Mill which ran from 85 to 88 per minute. I expected this particular point would be criticized by members present. We still continue to use the same form of mortar, and recover 92 per cent. of all the gold obtained inside the mortar.

MOTION TO APPOINT AN OFFICIAL TO REPRESENT NOVA SCOTIA AT THE MONTREAL CONVENTION.

It was moved by Mr. J. E. Hardman and seconded by Mr. Chas. Archibald, as follows: "In view of the importance of the February meeting at Montreal in the matter of legislation affecting mines, this Society deems it wise and expedient that the Provincial Government should be represented at that meeting, therefore be it resolved that the secretary is hereby instructed to communicate with the Honorable Commissioner of Public Works and Mines and to request, on behalf of the Society, that Dr. Gilpin be appointed the official representative of the Province at that meeting."

The said motion upon being put was passed unanimously.

The meeting then adjourned to meet at 2.30 p.m.

AFTERNOON SESSION.

The Society met at 2.30. Papers on "Late Modification of Coal Mining in Nova Scotia" were read by Mr. Chas. Archibald, manager Gowrie Coal Mining Company, Cow Bay, C.B.; Mr. James Baird, manager Canada Coal and Rail Company, Joggins' Mines, N.S., and by Mr. H. S. Poole, for J. G. Rutherford, Acadia Coal Company, Stellarton, N.S., and for Mr. Maxwell, also of the Acadia Coal Company. All of the above papers will be printed in the Society's Transactions.

On motion a vote of thanks was passed to each of the gentleman who had contributed a paper.

After discussion it was resolved that these papers, descriptive of late Nova Scotia practice in coal mining should be consolidated and presented as a joint paper at the special meeting of the Society to be held in Montreal during the session of the International Mining Convention.

There was an informal meeting of the Society at the Halifax Hotel in the evening, at which mining matters were freely discussed.

Special Meeting of the General Mining Association of Quebec—The Powder Tax Condemned—The Arrangements for the International Mining Convention.

On the call of the Council a Special Meeting of the General Mining Association of the Province of Quebec, was held in the office of the Treasurer, Mr. A. W. Stevenson, C.A., at 17 St. John street, Montreal, on Friday, 9th instant. There was a good attendance. Among others present being noticed: Mr. James King, M.P.P., (King Bros.) Quebec; Mr. L. A. Klein, (American Abestos Co.) Black Lake; Mr. John J. Penhale, (United Abestos Co.) Black Lake; Mr. W. H. Jeffrey, (Jeffrey's Asbestos Mine) Montreal; Mr. S. P. Franchot, (Emerald and Central Lake Mining Companies) Buckingham; J. Burley Smith, (British Phosphate Co.) Glen Almond; Hector McRae, (Electric Mining Co.) Ottawa; C. Circkel, (Templeton Abestos Co.) Templeton; J. Lainson Wills, F.C.S., Ottawa; W. A. Allan, (Little Rapids Mining Co.) Ottawa; George R. Smith, (Bell's Abestos Co.) Thesford; W. H. Irwin and R. T. Hopper, (Anglo-Canadian Asbestos Co.) Montreal; T. P. Bacon, (New Rockland Slate Co) Montreal; Prof. C. H. McLeod, Secretary, Canadian Society of Civil Engineers, Montreal; Prof. B. J. Harrington, McGill University, Montreal; A. W. Stevenson, C.A., Montreal, Treasurer; B. T. A. Bell, Ottawa, Secretary; and Col. Lucke, (Beaver Asbestos Co.) Sherbrooke. In the unavoidable absence of the Hon. George Irvine, Q.C., President, Mr. James King, M.P.P., Vice-President, was called to the chair.

ANOTHER KICK AGAINST THE POWDER TAX.

THE SECRETARY having read the minutes of the previous meeting and the notice convening the members, explained that as several members of the Association had been served with notices threatening immediate execution of the law for non-payment of the $150 license tax on powder magazines in the province, it had been decided to call the members together to consider what steps should be taken. Some of the members had suggested testing the legality of the Act in the courts, while others were in favor of approaching the Government and asking for its abolition or amelioration.

MR. JAMES KING, M.P.P.—Our President, the Hon. George Irvine, Q.C., told me the tax was legal and my company paid it. So had many others.

MR. L. A. KLEIN—I do not think that the law was framed with the object of taxing mines, but rather as a safeguard for the proper storage of explosives in large cities like Montreal and Quebec. There was a clause in the Act which left the taxing of mines, quarries and railroad works within the discretion of the Lieutenant-Governor in Council. I would suggest that a deputation from the Association wait on the Government and point out the burdensome nature of the impost on an industry which deserved encouragement rather than restriction. The Government should be asked that the mining industry be exempted from the application of the tax.

MR. W. H. JEFFREY—The tax is injust, and I will test it even if no one will assist me.

COL. LUCKE—I will assist you. I will not pay until I am compelled to.

MR. T. P. BACON—Our company received a threatening letter from the collector, but after getting a legal opinion thought it best to pay up.

MR. W. H. IRWIN—There can be no doubt that the tax is a very onerous burden. He thought the better plan would be to see the Government and explain its hardship and if possible get it remedied. He would move the following resolution:

"*Resolved* that a deputation, to be nominated by the chairman, wait upon the Quebec Government and lay before it the sense of this meeting regarding the imposition of the Powder Tax as applied to mines, with a view to inducing the Lieutenant-Governor in Council to exercise his right of exempting the mines of this Province, as provided for in the Powder Act, and that as an alternative the Government be requested to grant a case to test the legality of the Act."

MR. J. BURLEY SMITH—The tax is an iniquity which should be combated. He would co-operate in a measure of resistance.

THE SECRETARY recommended a policy of conciliation. There was no use of "kicking against the pricks." That the Act was legal enough was shown by the opinion of their President, who was a member of the Government when it was framed, and it had been endorsed by many of the company's solicitors who had been consulted regarding it. There could be no doubt of the injustice of the Act. It was a tax on industry. The Government might just as reasonably make an impost on their picks and shovels. To companies operating a number of pits on one property, and where the minimum quantity of powder stated by the Act was a necessity at all, the tax was practically prohibitive.

MR. IRWIN'S motion having been seconded was put to the meeting and carried.

THE CHAIRMAN then named the following deputation: L. A. Klein, Black Lake; J. Burley Smith, Glen Almond; S. P. Franchot, Buckingham; Col. Lucke, Sherbrooke; Hon. George Irvine, Quebec; and James King, M.P.P., Quebec.

THE INTERNATIONAL MINING CONVENTION.

THE SECRETARY submitted the correspondence with reference to the meeting of the American Institute of Mining Engineers and the International Mining Convention, to be held in Montreal during the week beginning 21st February next. Dr. Raymond had intimated that so far 160 gentlemen and 69 ladies had signified their intention of being present. The Mining Society of Nova Scotia would attend in a body and hold a special session. The Dominion Government had voted $1000 towards expenses, and the Hon. E. J. Flynn had promised to recommend an application for a similar amount to the Quebec Government. The Mining Society of Nova Scotia would arrange its programme of papers and discussions, and Ontario would be represented by a committee consisting of Messrs. W. Hamilton Merritt, M.E., Toronto, (chairman); A. Blue, Director of Mines, Toronto; Prof. C. Gordon Richardson, Toronto; T. D. Ledyard, Toronto; E. N. Rathbun, Deseronto; J. Bawden, Kingston, and G. Mickle, Sudbury. These gentlemen would, in conjunction with the Provincial Mining Association of this Province, formulate a programme that would represent the interests of Ontario. So far as he could note, the attendance from all sources would not be much short of 600. The Canadian Society of Civil Engineers had adjourned its annual meeting to the date of the Convention, so there would be meeting in Montreal at one time the greatest Convention of engineers ever held in this country. The list of papers promised was large and thoroughly representative of the interests of the country.

On motion Messrs. Stevenson, Irwin, Gardiner, Hopper and the Secretary were named a committee to arrange a programme of entertainmeat for visiting members.

THE CASE OF CAPT. T. J. WATTERS.

THE SECRETARY—I have been asked by a number of members to submit for consideration the question as to whether a Civil Servant should be debarred from investing his means in mining. As you all know many Civil Servants in the employ of the Dominion Government are engaged indirectly in the operation of mines of phosphate and mica. As an instance it is well known that Capt. T. J. Watters, an officer of the Customs Department at Ottawa, has invested heavily in establishing the mica mining industry in the County of Ottawa, on a scale that is highly creditable. But the question has been raised that Capt. Watters has no right to invest his money in mining and is debarred by the Civil Service Act from engaging in anyway in any enterprise beyond his official duties. Some of our members think that this application of the Civil Service Act is an injustice and would like it considered by the Association.

MR. J. BURLEY SMITH—I am strongly opposed to the policy of permitting a public servant using his time in a private enterprise.

COL. LUCKE—As it is now dinner time, I beg to move the adjournment of the meeting. I hardly think Capt. Watters' case comes within the scope of this Association—it is a matter between Capt. Watters and the Government.

The meeting then adjourned.

COMPLIMENTARY DINNER TO MR. C. CIRCKEL.

In the evening at half past seven o'clock, the members assembled at the Vienna Cafe to give a "send-off" to their genial confrere, Mr. C. Circkel, M.E., manager of the Templeton Asbestos Company, who was about to leave for Europe. About twenty-five sat down at the table, including: A. W. Stevenson, C. A., Montreal; His Honor Judge Dugas, Montreal; J. N. Greenshields, Q.C., Montreal; Col. Lucke, Sherbrooke; L. A. Klein, Black Lake; W. A. Allan, Ottawa; J. Lainson Wills, Ottawa; A. Merrill, Templeton; George R. Smith, Black Lake; W. Bell, Montreal; S. P. Franchot, Buckingham; C. W. Morgan, Toronto; Hector McRae, Ottawa; John J. Penhale, Black Lake; F. P. Bacon, Montreal; J. Burley Smith, Glen Almond; R. Bond, Montreal; Robt. Gardiner, Montreal. Mr. A. W. Stevenson, treasurer of the Association, presided, having on his right hand the guest of the evening, and on his left His Honor Judge Dugas. Mr. S. P. Franchot acted as croupier. After an excellent dinner and the usual loyal and patriotic toasts had been honored, the chairman in few graceful sentences, proposed the toast of their good friend Mr. Circkel, who was about to leave them for a short time. Although only a little over a year in their midst his geniality and *bon homme* had won him hosts of friends, and he hoped that they would all see him back again early in the New Year, invigorated by his trip for renewed activity at the mines, The toast was honored with three times three and a tiger and "He's a jolly good fellow." Mr. Circkel responded by briefly thanking the members for the honor they had done him. Since coming to Canada he had been treated with the greatest kindness. He could not find words sufficient to express all he would like to say, but with their permission he would play and sing something for their entertainment. Mr. Circkel then delighted the company with a selection from his German songs. His Honor Judge Dugas followed with some particularly happy allusions to the subject of "the Law," and was succeeded by Mr. J. N. Greenshields, Q. C., who declared in a vigorous speech that it was the bounden duty of Governments and Parliaments to encourage in every possible manner the development of the great natural resources of the country. Too much money has been wasted, he said, on effete schemes to build railways where they were not required, and to promote other equally futile enterprises. Considerable humour was manifest in the capital speech of Mr. S. P. Franchot, while the drollery of the stories told by Mr. Hector McRae was inimitable. The remainder of the evening was pleasantly spent in song and sentiment to which Messrs. W. Bell, George R. Smith, Col. Lucke, B. T. A. Bell and J. Lainson Wills contributed. Tne company separated at midnight.

The Iron Industry of Canada—Its Position and Prospects.

(Colliery Guardian.)

It is not, perhaps, too much to say that no hopes or expectations indulged in by the iron and steel industries of the United Kingdom have been more signally disappointed than those which have been built upon the development of the iron and steel requirements of the British colonies. The growth of the demand for our metals in those regions has not by any means kept pace with the growth of population, or with the reasonable expectations built upon the actual requirements of the colonies, in the form of railways and other works of public improvement. Why this should be so it is not easy to explain. Works of public utility have been pushed forward in some of our colonies to a notable extent, and with characteristic enterprise, but the capital is lacking to enable them to go ahead as English manufacturers would like. India, for example, has only now a railway system of some 16,000 miles, or less than one-tenth part of the railway system of the United States. Canada, "the larger half of the North American continent," as it is grandiloquently termed, has not even such an extensive system as India. The Australasian continent, with an area exceeding that of either India or Canada, has less than one-half the railway mileage of either. As with railways, so with other works of public improvement into which the use of iron and steel enters as an element of importance, and hence it happens that the whole of Greater Britain, extending to over 8 millions of square miles, or nearly three times the area of the United States, excluding Alaska, had, in 1891, a total demand for iron and steel under a million and a-half of tons, or less than a fifth part of the total consumption of the United States, of which the mother country furnished exactly 1,131,786 tons in all. Taking the three principal colonial consumers, the quantities taken by each in the years 1882 and 1891—an interval of ten years—were as under—

	1882. Tons.	1891. Tons.
Australasia.....	302,450	401,800
India.....	274,925	305,974
Canada.....	246,516	206,904
Total.....	823,891	914,678

The total increase shown on a comparison of these two years is only 90,789 tons—a perfectly insignificant increase when the growth of the three possessions dealt with is considered. Nor have our colonies of the second rank a much better record to show. The figures are appended for four of the next most important colonies :—

	1882. Tons.	1891. Tons.
Cape of Good Hope.....	68,315	113,067
Natal.....	13,347	30,887
Ceylon.....	9,300	10,140
British West Indies.....	12,501	11,689
Totals.....	103,563	165,783

Here we have a total increase of 62,320 tons, principally in the demands of the Cape of Good Hope. The increased demands of all the seven principal possessions dealt with, would scarcely keep a good-sized English ironworks busy for a single year. The increase in the other minor colonies is comparatively trifling, and does not, at the most, exceed a few thousands of tons in each case.

But there is another matter which is calculated to excite as much apprehension and dissatisfaction as the circumstances already stated, and that is the anxiety of some of our principal colonies to provide for their own requirements in iron and steel. This disposition has been more especially apparent in India, Canada, and New South Wales. In India, the matter is, of course, entirely in the hands of the Government, and of such capitalists as choose to go into such speculations. The Government have bestowed some attention, and expended some money, in attempting to arrive at an accurate knowledge of the real resources of the country for the prosecution of the iron manufacture. In more ways than one they have offered encouragement to capitalists to embark in the iron trade in the most favourable situated localities, but up to the present time, not much has been done in that direction. In Canada, the establishment of a home iron industry has for years past been the avowed wish and aim of the Government, and in his well-known Budget speech of 1887, Sir Charles Tupper, after notifying to the Canadian Parliament that the charcoal iron manufacture was formerly one of the most important industries of Ontario and Quebec, proceeded to state that "if the protection we have given cotton and woollen, and all other industries of Canada, be applied to iron, to-morrow will show what the past history of Canada has shown—that these charcoal furnaces will again be in full blast, and that in Ontario and Quebec they will become most essential and important industries in the future." In pursuance of this programme. the Canadian Government raised the duty on pig iron to 15s. per ton, and at the same time offered a bounty of a dollar and a-half a ton for every ton of pig iron made in the Dominion. It is not a little singular that in spite of all these inducements, and of the almost certain command of a market to the extent of between 200,000 and 300,000 tons a year, not much progress has been made in the way of realising the programme of the Government. This has not been because of the scarcity or the inferior quality of the natural resources of the country. Pictou County, Nova Scotia, where several blast furnaces are already carried on by the New Glasgow and Londonderry companies, is rich in several varieties of ore, notably brown hematites and spathose and specular ores, the former varying from 50 to 60 per cent. of iron, and the spathose ores from 40 to 45 per cent. Bog iron ores and clay ironstone are also found in several districts, and in Ontario, running through a number of townships, there is a deposit of ore of such high quality that a railway has been constructed over 100 miles in length to carry it to Weller's Bay, in order that it might be shipped across the lake to Charlotte, Oswego and other places in the United States. Nevertheless, the trade has never assumed large proportions. Indeed, the largest quantity of iron ore raised in Canada in a single year has hitherto fallen short of 100,000 tons, valued at the mines, in the official mineral statistics, at about 7s. 2d. per ton. Assuming about two tons of ore to the ton of pig, it would appear as if this ore were equal to the production of from 40,000 to 50,000 tons of pig iron a year, but the actual quantity of pig made in Canada has not until recently come up to that figure. Probably owing to the comparatively small scale on which Canadian ores are worked, the cost of production appears to be somewhat high. In many cases the cost runs up to about 7s. per ton, and in the most favourable conditions it does not appear to fall below a dollar. At the Acadia Mines, in Nova Scotia, according to a report made to Dr. Selwyn, the director of the Geological Survey, some years ago, the ores cost about a dollar per ton at the mouth of the level, exclusive of dead work, which, however, almost doubled this cost. At the furnace where it was smelted, in Nova Scotia, this ore cost about 2½ dols. per ton, or practically as much as the Bilbao ore cost delivered in England, after a transport of over a thousand miles. The Londonderry Works, which use this ore, were completed in 1853, but they have since been extended. The furnace first erected, and used until quite recently, was 35 ft. high only, with a bosh of 9 ft. The blast was cold, and was produced by water-power until 1874. The cost of producing a ton of iron at the same time was stated to be 20 dols. 68 c., or over 80s., per ton, but the blast furnace was only in blast for six or seven months at a time, and was tapped about once in every six hours.

Since then, the ironworks established in Nova Scotia have come more fully abreast of modern requirements and practice. During the present year the New Glasgow Iron Company, which is, perhaps, the most enterprising undertaking of its kind in the Dominion, has blown in a furnace of modern type, and is otherwise extending its plant, so as to embrace the production of various descriptions of merchant iron and steel, including rails, while it is said to be raising about 200 tons of iron ore daliy from the present mines, which would represent from 20,000 to 30,000 tons of pig iron. The Pictou Charcoal Company has erected a new furnace in the same region for smelting the ores in the neighborhood, and they are said to contemplate adding mills and forges. In Annapolis Valley, also in Pictou County, the Londonderry County, one of the oldest in the district, has recently undertaken the development of a very promising ore property, which is already equipped for the production of some 200 tons a day. There is a good deal of talk of other exterprises being started in the same promising locality. Nova Scotia does undoubtedly possess unique advantages for the prosecution of a successful iron industry. Coal of good quality, and suitable fluxes, are found alongside excellent iron ores—the three necessary raw materials being found in abundance within a radius of from twelve to twenty miles. There are very few localities in the world that present this conjunction. In the neighboring country of the United States, the ores have generally

to be brought from 700 to 1,000 miles to the coalfield. In the United Kingdom, about one-fourth of all the ore smelted has to be brought from the north of Spain. In Germany the greater part of the ores smelted by Westphalian works have to be brought thither from Luxemburg and Meurthe-et-Moselle, and so with the now comparatively smaller iron industry of Belgium. But while Pictou County has the advantages referred to, it labours under the disadvantage of being far removed from the principal markets, whether of Canada or of other countries. Montreal, the chief market of the Dominion, where there are several important foundries and engineering works, is about 700 miles by the Intercolonial Railway, which might possibly charge the makers of iron and steel monopoly rates. On the other hand Pictou has a harbour that is tolerably well established, and is open all the year round, so that in the summer months, at any rate, there would be competition by the St. Lawrence River with the railway. So far as the cost of producing pig and other iron at Pictou is concerned, there would appear to be no good reason why it should not be moderate, when the mines and furnaces have been more fully developed. There is said to be an ample command of labour at a fairly reasonable rate of wages—much under that paid in the United States. The people of Nova Scotia look forward to obtaining a hold in the United States markets, but this is hardly likely while the present duties are in force. Besides, it is probable that the rate of freight from Pictou to Boston, New York, or Philadelphia would be considerably more than the rate from England, so that unless Pictou made cheaper iron than the "mother country," the chances of its iron occupying any notable place in the imports of the United States would be but small.

Iron ores of good quality are found in considerable abundance in other parts of Canada, and to a large extent in Ontario, as already indicated, but as these ores are far removed from suitable coal deposits, they can only be used in charcoal furnaces –which would mean a very limited consumption—or exported to the United States. It would appear as if iron ores that had only to be sent a few hundred miles at the most by railway, should be able to compete with ores that are sent by sea for a distance of between 4,000 and 4,500 miles, as is some of the principal ores now imported into the United States from Spain,&c.; but as a matter of fact the United States import the Spanish ores to a large extent, and the Canadian ores to a very limited extent indeed. The prospects that lie before the owners of Ontario ores is not therefore very brilliant. Whether they are likely to be improved, and by what means, we shall consider, with other matters, in a future article.

The Coal Fields of Cape Breton.

Robert Robertson, Jun.

(Further communication to the Mining Institute of Scotland.)

The seam worked under the sea at Sydney Mines maintains an average thickness of 5½ feet, varying from 4 ft. 9 in. to 6 ft. ¼ in., and dips at the rate of 1 in. 6 to 1 in. 7.

The proportion of coal worked is about 40 per cent. and the highest point of the workings above the level of the pit bottom has a cover of 353 feet, and from that point to another point in the same section, having a cover of 370 feet, and 600 yards apart, encloses the only area where water in any quantity comes from the roof. The quantity of water met with up to the present is, however, very inconsiderable, the greater part of it being collected by means of dams to prevent it flowing towards the dip workings, and is conveyed to the bottom by gravity in malleable tubes from 1 in. to 2 in in diameter. The quantity delivered at the bottom is only 5 gallons per minute. All the water made in the workings, which are all towards the dip, is conveyed to the shaft in tubs, equal in capacity to the coal tubs, and does not exceed twelve tubs per day.

From those points mentioned above the thickness of cover gradually increases, until at the lowest point of the workings it attains a thickness of 1050 feet.

The depth of water is very uniform over a large area, both in the harbour and out seawards, ranging from 40 to 50 feet.

The annexed plan of the part of the workings referred to shows the method of working, and also the area in which all the roof water is met with.

This section is now in operation, as it was feared that the quantity of water might become greater, and prove troublesome in the dip workings, and, as these workings were approaching a break in the strata which runs through the length of Sydney Harbour, the management decided to cease working in that direction. At the point marked A there is 370 feet of cover, and at B 353 feet.

It will thus be seen by the accompanying sketch that the face of the main levels is considerably higher than the bottom of the shaft, there being no less than 230 feet of rise on the level. This is accounted for by the change of the direction of the line of dip, and the levels being continued on the same bearing.

The coal measures consist of a great accumulation of sedimentary strata of shale, sandstone, and fireclay, of which the shales constitute in thickness nearly two-thirds of the whole. They are in part argillaccous and arenaceous, but in most cases carbonaceous and bituminous. The first are of a grey or bluish grey colour, but occasionally tinged red with the peroxide of iron.

The sandstone beds are generally of considerable thickness, mostly coarse-grained, rarely pebbly, and false bedding is very frequent. The manner in which the most delicate and fragile ferns are preserved in the shale beds proves that they were deposited in quiet shallow waters, while the sandstone, except in a few instances, appears to have accumulated under conditions of an opposite character.

The following section of the strata in the shaft may be of some interest :—

	Feet.	Inches.
Strata, various, not accurately noted.	81	3
Coal, (Lloyd's seam)	66	8
Shales and sandstones	172	5
Coal	0	3
Shales and under clays	9	6
Hard sandstone	33	0
Coal	0	9
Soft shale	1	10
Coal	0	8
Under clay, coaly shales, and coal	11	0
Strong dark grey sandstone	10	8
Shales, coal, and under clays	7	0
Slaty sandstone, with micaceous partings	16	9
Hard dark blue shale, with ironstone bands	4	0
Coal	1	2½
Band of black shale and clay	0	4½
Coal and shale mixed	0	10½
Soft clay and band	1	1
Under clay, with stigmaria rootlets	10	2
Soft blue till	8	8
Coal, coarse and brassy	0	2
Under clay	2	0
Coal, bright and good, carb. limeveins	0	2½
Under clay, with stigmaria rootlets	1	4
Grey slaty shale, with iron balls	3	2
Soft shales, grey or bluish	7	8
Sandstone, grey, getting harder towards bottom	8	3
Blue till or shale	3	5
Red till or shale, soft and hard	3	2
Hard, close-grained blue till	4	2
Red shale, soft, like marl, and chalk	0	10
Strong blue shale	3	3
Red shale	6	5
Grey and greenish crumbly shale	16	3
Red shale	2	0
Grey and bluish hard shales	8	9
Hard close-grained shale	2	0
Hard close-grained sandstone, with cutters	23	0
Blue shale	4	4
Black shale, clay parting over it, with gas	1	8
Dark blue shale	9	5
Black shale, with clay above and below	0	4
Blue shale	5	8
Black shale	2	6
Blue shale, sandy	3	7
Blue shale, softer	8	4
Coal	0	5
Sandy shale, or mixed shale and sandstone	11	6
Red shale	2	6
Grecnish hard compact shale	2	2
Sandstone and strong sandy shale	10	10
Red shale	1	0
Sandstone	3	3
Red shale	9	5
Hard sandstone	12	6
Blue till	15	5
Soft shale, with calamites and coal	0	1½
Coal and shale mixed	1	5½
Strong sandy shale	4	7
Fireclay	3	3
Blue sandy shale	5	7
Hard sandstone	0	6
Sandstone	9	1
Hard slaty blue shale, with calamites	4	0
Blue or olive shale, with some black, and signs of fossils, clay parting below	1	9
Hard sandstone	1	0
Blue and black shale, fossils, lingula and small shells and scales of fishes	1	4
Blue shale	7	4
Black shale, full of shells	0	9
Dark blue or olive shale	0	6
Grey crumbly or slickensided shale, or fireclay, or under clay	9	6
Strong hard grey sandstone	10	6
Strong hard white sandstone	21	1
Hard blue shale and sandstone	4	0
Slaty sandstone, with black coloured partings and marks (micaceous)	2	6
Strong white sandstone	5	1
Strong white sandstone, with black partings, but strong and close	8	0½
Coal	6	0
Total depth	680	11½

The Cornish pumping engine is being dispensed with on account of the heavy expense incurred by frequent breakages of the pump rods. The copperas water, coming from the old workings to the rise, has a very injurious effect on the plates and bolts, causing frequent breaks, and necessitating the frequent drawing of the rods.

Underground Haulage by Endless Rope at Ansley Hall Colliery.

(Paper by W. G. Phillips before Chesterfield and Midland Counties Institute of Engineers.)

The great importance of the question of underground haulage was attested by the attention the subject has received from time to time from mining engineers competent to deal with the subject in several able and exhaustive papers, and was further shown by the great interest taken by all connected with coal-mining wherever the underground haulage of coal was performed by machinery, to the partial or entire exclusion of horse or manual haulage. Nor was this a matter of wonder when they considered how much of the success of colliery operations depended upon the fact that, whatever the system of haulage employed, it should be such a one as would ensure the certain and expeditious removal of the production of the collier from the remotest as well as the nearest working place in the pit, and at the same time be economic in its working. The various systems of underground mechanical haulage were pretty generally known, and the writer did not intend in this paper to enter into the merits or demerits of any of the known systems, but simply to set forth the particulars, and the working of the system he had adopted at Ansley Hall Colliery, and which had been in successful operation for a period of five years, to the entire exclusion of horse haulage.

The pits are 13 feet 6 inches in diameter, and are sunk to a depth of 168 yards, intersecting the Rider Coal at 68 yards deep. From the bottom of the shaft a crut or measures head is driven to the Deep, cutting the Rider Coal at 325 yards from the pit bottom.

At this point the measures are lying at an angle of 25 degs., and to reduce the gradient an incline to open out the Deep Coal has been driven to the side of the dip, and the levels driven out from the bottom. The length of the incline is 480 yards. The Rider Seam is worked on the longwall system, opening off from a rib or pillar 32 yards thick, in this instance, left to support the haulage road or level. In the present case eight stalls are at work, with a working face of nearly 1,100 yards. The coal from these stalls is jigged down the gate-roads, the number of tubs jigged at each run varying from three to six, and the average length of each gate-road is over 400 yards at the present time. The Rider Seam has a workable thickness of 6 feet, and reposes upon another seam, the Bare Coal, 4 feet 2 inches thick, with a fire-clay parting intervening, and varying in thickness from 12 inches to a thin "scud." The Bare Coal is unmarketable, and therefore not worked. Immediately overlying the Rider is a heavy blue bind 24 feet thick, and immediately underneath the Bare Coal is a bed of fire-clay eight feet thick. The former is a bad roof, and the latter is a worse floor, inasmuch as the Bare Coal makes sufficient water to set the fire-clay heaving, and thus give considerable trouble.

It is, therefore, very desirable to make the headings between the two seams, leaving a good thickness of Rider Coal to form a roof, and more than half the Bare Coal to form a floor. The measures are very undulating, and thus the crookedness of the haulage road or level is accounted for.

The coal left to form the roof of the main road is only partially successful, and a great part of the roads are supported.

When the roof coal breaks down steel girders 50 lbs. to the yard are used in the main roads.

The haulage is by endless rope driven by engines working on the surface, the rope travelling in the winding shaft, and proceeding from the pit bottom underneath the tubs.

The speed of the rope is 2 to 2½ miles per hour. The tubs are attached singly to the rope by means of a clip, and are put on not nearer than 20 yards apart on the main rope; but on the level, which is worked by another rope driven by the main rope, there is no prescribed distance for clipping on the full tubs, and it is not uncommon to see a dozen full tubs within a yard or a yard and a half of each other.

The empty tubs are put on the rope within a few yards after leaving the cage, and they proceed to the bottom of the incline, where they are detached and run by gravitation.

The hanger-on at the bottom of the incline detaches the empty tubs, and attaches the full ones, which latter are detached by a youth at point, from which they run by gravitation to the hanger-on at the pit bottom to be caged.

At point, a youth detaches the full tubs from the level rope, and they run by gravitation to the hanger-on at the bottom of the incline, and he attaches the empty tubs to the level rope to go in-bye

At the bottom of each jig or gate-board, standing room sufficient for the number of tubs composing the run or journey is provided, and the hanger-on at the bottom of each jig takes the empty tubs he requires off, and attaches the loaded ones from his gate-road to the level rope.

Two "doggies" or "corporals" are employed to superintend the haulage on the level, and to pick up any little defect which may develop during the working.

A pair of semi-portable engines by Fowler, of Leeds, are placed on the surface- They were originally employed in their present position for sinking, and were not intended for the purpose for which they are now used.

The rope driving wheel is of the "C" class, 8 feet diameter, and is of cast iron. The rim of the wheel is in semi-circular segments, bolted together and secured to the arms of the wheel by means of sockets, into which the arms are dove-tailed, the connections wedged up with dry hard wood wedges, and further with small iron wedges driven into the wood. The rim, when worn out, can be replaced by a new one with comparatively little difficulty.

Although the writer has had good duty from the wheel he is now working, he would strongly recommend that the wheel should be cast with a plain rim with the arms, and that the C segments should be of steel, and be bolted on the rim of the wheel. The life of the segments would be much longer, and they could be replaced with less difficulty than in the other manner described.

The rope, after going three full turns round the C wheel, is led over 6 feet pulleys fixed upon wood headgear, and down the shaft. The vertical pulleys leading the rope are 6 feet in diameter. The empty or in-bye rope is led round the back of the pit bottom by two horizontal pulleys, each 4 feet in diameter, working loose underneath the plates, or flat sheets, on spindles fixed into cast-iron plates resting upon pitch pine beams, the rope emerging from the under side of the road.

Steel rollers in cast-iron frames are fixed every 15 yards for carrying the rope and keeping it from the ground.

The curve A at the top of the incline having to bear practically the whole weight of the haulage, was put down correspondingly strong.

The whole of the rollers are steel; all the spindles are wrought-iron, turned, and the rollers are bored out.

The sleepers are pitch pine, 12 inches by 6 inches, some of which are joggled into the side, and a strong post set on the middle one, for the purpose of keeping the curve from lifting with the working.

It was a question with the writer when laying down this system whether to make these junctions with rails and points or with plates.

It was found, however, that the limited room which the nature of the strata allowed would have made the working of the junctions with rails and points very troublesome, and plates were adopted, and have worked very satisfactorily. The plates are laid so as to leave a groove 1 inch wide in the track of the rope in each road, into which the rope sinks when the tubs are not passing over, and the hanger-on is enabled to push his full tub across the plates to the deep side road without any impediment. The length of the coupling of the clip is so arranged that when the tubs are passing over the plates the rope is lifted by the clip out of the groove, and thus avoids the possibility of the clip getting fast in the groove.

A most important matter in endless-rope haulage is the clip, or hook, or whatever may be the name given to the means of attachment of the tub to the rope.

The one the writer has adopted and used for over five years is the invention of Mr. T. W. Smallman, of Nuneaton.

It is made of steel or malleable iron, and is formed of two sides between which works a lever. A fulcrum is formed by a steel peg a short distance from the back end of the lever, on which end is formed a wedge-shaped preparation. Below the fulcrum of the lever a strong bolt couples the sides, and by which the range of the clip is regulated, and at the back of the clip is a pin to which the coupling is attached.

The action of the clip depends upon the wedge-shaped end of the lever working in an inclined recess formed in the inside of the plates. To release the clip from the rope the lever is lifted up, the wedge end being brought to the aperture in the sides, which are then released from their grip. To attach this clip the hanger-on takes it by the end of the lever with one hand, and swings or flings the hook into the draw-bar of the tub without touching it with the other hand, holding the lever in a vertical position; the lower edges of the sides are apart, and dropping the clip on the rope he brings the handle down with both hands.

One item in favour of endless-rope haulage as compared with horse-haulage seemed to have been overlooked by previous writers, but was one of no inconsiderable moment. This referred to the great wear of sleepers, and the cost of labour in keeping a road subject to heavy horse traffic. The extra cost in this department would do something towards liquidating the cost of ropes and rollers. With respect to the wear and tear of tubs, in the working of inclines with varying but heavy gradients, it must be self-evident that the distribution of the weight over the full length of the incline, in single tubs, equalized the strain on the whole of the haulage tackle, and thus reduced the risk of breakages, whilst the absence of coupled trains running at considerable speed on such inclines removed the cause of much damage to tubs. The writer was not prepared with a detailed statement of the cost of his tub repairs, but he found that the average cost for labour was not more than £25 per annum.

In conclusion, the writer apologized for the absence of many particulars which would have added interest to the paper, but which for the lack of time he had been unable to supply.

Fatal Accident at the Malaga Gold Mine, N. S.

On Thursday 15th inst., Joseph Francis was killed, and two miners injured, by an explosion of a miss-fire shot at the mine of the Malaga Gold Mining Company, at Malaga, Queen's County, Nova Scotia. It appears that the deceased miner, who was working at the bottom of the pit, started to clean out a hole that had missed fire the day previous. He succeeded in getting down to the cartridge, withdrew the cap and passed it to his partner, continued to drill out the dynamite, though he had been previously warned by Mr. Thomas, one of the foremen, not to do so. Shortly afterward the cartridge exploded, killing Francis instantly, and severely injuring Joseph Wamboldt, who was very near at the time, and Lamont Simpson who was at work a few feet away. Though many of the men were working near the fatal spot, all escaped uninjured, except those mentioned above. At the coroner's inquest a verdict of accidental death was returned.

MINING NOTES.

[From our Own Correspondents.]

Nova Scotia.

Pictou County.

On Wednesday forenoon, 7th inst., Overman Johnston finding a number of feeders in the Tunnel which is to connect the main seam of the Drummond colliery with the Scott pit or Sweet William, and also noticing that the air was a trifle dull, gave instructions that no shots were to be fired until brattice was put up. The shiftmen attended to the bratticing. The afternoon shift came on at two o'clock, Overman Quigley relieving Overman Johnston. The brattice being put up it was considered that the place was free of gas, and the shift fired two shots in the coal, and loaded it away. Nothing wrong was notice with the shots, both having done their work well. A third shot was standing ready in the stone over the coal, which should have been fired on the first shift—had the air been satisfactory. Before firing this prepared 'shot' the second shift mined it two feet further in order to give the charge every play. Before the shot was fired Overman Quigley examined the place thoroughly and found all clear. The men came out and the battery was attached to the wire and set off. Simultaneously with the firing of this shot came an explosion of moderate force, which knocked the men down, blowing out their lights. After relighting their lamps the men made for the "face" and found the coal on fire. They worked until exhausted and overcome with damp, but the fire was master. They then ran to the bank for assistance. When they returned the damp was so strong that lamps would not burn within a hundred feet and little progress was made. Then the pumps were connected with pipes leading to the fire and also hose. The hose gave way. Then pipes had to be obtained to replace the hose. A hand fan was called into requisition to enable the men to work. The water was played on to the fire, but without success. Several times it was thought under control, but the gas exploded again, slightly burning and hurting a few of the men. A half hour later another attempt was made, but another explosion following, the men were forced to retire. A consultation was then held and it was decided to force the water in to cover the fire. At date of printing the scene of the accident had been dammed off, and all danger was reported as past. The officials, the deputy Inspector and a large body of men did their duty faithfully. Some of the men lost their clothes, but the management will, no doubt, make these good.

Quebec.

Templeton.

The Charette property back of Perkins' Mills has been purchased by the Lake Girard Mica Mining System. Men are now engaged opening up shows and operations will be pushed in the spring. The same company is working the Murphy lot in Range 11. Buildings are being erected, machinery working, etc. 35 men and three teams are employed.

Mr. L. K. Lee has shut down his two lots on McGregor Lake for the winter.

The phosphate shipments from East Templeton this season has been the smallest for some years. Less than 2200 tons were shipped by rail and barge.

Wakefield.

The Lake Girard mine is now fully equipped with air compression, etc. The old shaft is turning out large quantities of mica at 200 feet depth.

Denholm.

Messrs. McRae & Co. are working ten men on their property at Long Lake. The mica is ruby of good quality. Operations will be continued through the winter.

Hull.

A fairly good show of white mica has been opened up on Charlebois' farm, in rear of the Hon. R. W. Scott's. Four crystals are in sight and the mining rights of the 50 acre range can be acquired for $10,000. At this figure the property will pay back—Charlebois.

Lievres River.

Mr. W. A. Allan is working 8 or 9 men at the Little Rapids. About 40 tons of amber mica has been turned out so far.

Messrs. Lewis Bros. & Co. have closed down for the winter. They have been working about 22 men all season on lot 14, in 3rd range. Output, about 25 tons trimmed mica.

Eastern Townships.

Things are looking prosperous at the Howard mines, Suffield, Que. A large force of men are employed in developing the property, and preparations for the immediate shipment of pyrites are being made. The Moulton Hill mine is temporarily closed.

Calumet Island.

Messrs. Russell have reached a depth of 32 feet in the shaft now being worked on their Zinc Blende deposit. A shipment of 30,000 lbs. was recently sent to Swansea, and there is a large quantity of ore at the mouth of the pit. Preparations for a large output next season are now going on. Six other openings than that mentioned above have been made on the property.

Ontario.

Hastings County.

The Crescent Gold Mine—The development of this property has steadily and intelligently progressed under the able management of the superintendent, Mr. Geo. McDougall, since May last, with a force varying from 30 to 45 men. The intention of the Company being more to develope the property than to raise a large quantity of ore. Owing to the very broken and distorted nature of the ground, the work had to be done near the surface, and although not yielding any great direct financial return, it has placed them in possession of very valuable information as to the staying qualities of the mine.

The tunnel to the length of 90 feet has been opened, disclosing a large body of low grade ore; a shaft has been sunk 95 feet on this vein. They are now prospecting on a vein about 300 feet west of the original, having a shaft 62 feet in depth sunk, and have just struck a vein five feet wide of quartz, heavily charged with mispickel, carrying gold from $20 to $80 per ton.

The surface work of this property by the original owners yielded very valuable returns, and now the present owners are on the point of being handsomely rewarded for their pluck and perseverence in spending the very considerable sum they must necessarily have done in order to prove the extent of the ore deposit.

The 10 stamp mill of most modern design is conveniently situated on the property, having a capacity of 20 tons in the 24 hours, and has crushed within the last three months about 1,200 tons of rock, which has yielded a paying quantity of gold, so that the general outlook for this property is very promising.

The Belmont Iron Mine, Lot 19, 1st Concession, Belmont, operated by the Belmont Bessemer Ore Company, Ltd., is not now being worked. During the year the ore deposit has been partially stripped. A fifty foot drift has been driven into the ore at a depth of forty feet, and a shaft house and ore dock built and other preparatory work done.

The mine can be put in good condition for shipping ore by the time the railroad, now being built to the mine, is completed, which will probably be early in the coming summer.

Belmont Gold Mine—The exploration of this property which was commenced in September, 1891, was continued until March of this year, and consisted of the sinking of a working shaft on the westerly portion of the north vein 10 x 10 to the depth of 95 feet, and two openings about 800 feet east on same vein to the respective depth of 21 and 27 feet, also a shaft on a vein to the south to the depth of 33 feet, besides other prospecting work and about 1,100 tons of ore raised, a shaft house erected, a substantial boarding house and office, blacksmith shop, etc.

All the ores so far mined consist of a quartz gangue, heavily charged with sulphides of iron and copper. Several hnndred tons of the ore were treated by the Crawford Mechanical Gold Extractor last winter, which proved the value of the ore, and the close saving that could be made by that process.

On the 11th October last, Mr. Middleton Crawford purchased a controlling interest in the property, and has since that time sunk the main shaft to a depth of 115 feet, has started drifting on the 30 and 70 foot levels, raising a sufficient quantity of ore to feed the new mill which he has erected. This mill at present contains two Crawford mills, a third is to be added the first of the ensuing year.

The ore will be all handled automatically, complete machinery for the purpose being placed in position, and everything promises a most systematic and economical manner of mining and milling.

Hastings Mining and Reduction Company—In June last, representatives of the Hastings Mining and Reduction Company, Ltd., of Toronto, visited several localities in the County, and finally decided upon establishing their works in the village of Marmora, where abundant and never failing water-power was secured from the Pearce Company, and on which a mill 40 x 76 has since been erected, and into which the machinery is now being put.

This Company proposes to treat the refractory arsenical gold ores which occur in this district, by the Walker Carter process, and Mr. Thos. Walker, of Philadelphia, Pa., is now superintending the erection of the plant.

The Hastings Mining and Reduction Company also secured some mining claims at Deloro, near the Consolidated Gold Mining Company's property, and a small force of men have for the past two months been engaged in active mining. Some 250 tons of rock ready for milling are already on the dumps, and in a few weeks, when the mill is ready for active operation, a larger force of miners will be put on. A little free gold is seen, but most of it is in the heavy sulphides, which have hitherto baffled all efforts made to extract the precious metal profitably, but

it is claimed that by the Walker-Carter process not less than 85 per cent. of the assay value of the gold can be secured. Should this expectation be realized, the development of the district will receive a decided impetus.

Prospecting—There has been considerable prospecting done in this county, and some good finds are reported in the Township of Tudor and Elziver.

In the latter a very rich silver vein has been struck which has been traced for some miles into the adjoining county.

The coming spring promises well for development work, as many of the owners of properties now lying idle are making arrangements for practically testing the quality and quantity of their ore deposits.

The Rathbun Company is seeking a bonus from the Ontario Government for the erection of a charcoal iron smelting works in Deseronto.

The North Hastings Mining Co., with headquarters at Marmora, has recently leased from Mr. T. P. Pearce of Toronto, the right to mine for a number of years on 20 acres of lot 8 in 8th con. of Marmora. Machinery of the most modern construction, costing $15,000, is now being delivered.

Reports have been received of another rich strike in the Lingham gold mine, township of Belmont.

Port Arthur District.

The Ogema Mine has again been placed under work; the manager stating that the returns from the shipment of ore were of such a satisfactory charactor as to warrant sinking 50 feet more.

Petrolia District.

The prevailing activity in drilling operations augurs confidence on the part of operators in the future of the trade, notwithstanding the fact that the market has recently become and still is somewhat, we may say considerably depressed. So far, since the fall season set in, the weather has been on the whole, favorable, and has been taken advantage of to the fullest extent practicable.

Major John Savage is at work on the Mutual Oil Company's property, with the intention of sinking a test well, perhaps several, to a depth of 2,500 feet feet, and should experiment result in demonstrating the truth of the theory adhered to by not a few thoughtful men, and that our staple is not confined to the depth to which wells average and consequentialy good paying finds become plentiful enough to create a big surplus of crude, it would appear to be reasonable to count upon a sweeping decline in prices which would have the effect of checking development and of limiting operations. Still it is premature just now to discuss this question, and we must only hope for the best.

The output by refiners continues fairly good with but little change to note in wholesale prices, as we pointed out in a former article; the matter of retail prices rests entirely with outside dealers, one thing is certain, that is, the refiners' profits are very slim, the percentage being much below that realized by dealers in other times.

British Columbia.

West Kootenay.

The sectional boiler and diamond drill outfit shipped to the Kootenay & Columbia Prospecting and Mining Company from Ottawa December 4th, reached Nelson, B.C., the 19th inst., and is now on its way into the Slocan district. Jos. Kelly, the expert driller who had charge of the tunnel borings at Northumberland Straits is in charge.

A half interest in the Stanley and Nip and Tuck claims has been traded by Duncan McDonald, of Nelson, to a Spokane syndicate. The other half is owned by Ottawa parties. Development work will be pushed on these claims next season.

Mr. Edward Watts, who has been working in the Kootenay district the past two seasons, is now on his way home to visit his family and will return in February.

A sample shipment of silver lead ore—10½ tons from the "Dardanelles" mine near Kaslo, gave $5,000 gross. the cost of mining, packing, etc., was $1,000, leaving a margin of $4,000.

Among the mines working in the Kaslo and Slocan districts for the winter are: Freddy Lee, 15 men; Washington, 12; Great Western, 9; Blue Bird, 15; Young Dominion, 4; Recau, 6; Best, 6; Dardanelles, 12; Northern Belle, 4; Lueky Jim, 15; Wellington, 8; Idaho, 8; Slocan Boy, 6; Mountain Chief, 6; Montezuma, 8; Four Mile creek claims, 16. Total, 150. This means a disbursement of over $25,000 a month for wages and supplies.

In an interview with the *Colonist* Mr. E. C. Campbell says: "People outside the mining region are often inclined to think that if there be such mineral wealth in the country, and the fact could be established, there would be no lack of capital to develop it. Such people ask, "What of all this bonded property of which we hear? Why not do some development work and not always be prospecting?"

The answer is that the bonding of property is a *bona fide* transaction, and that while English capital will not be invested until everything is demonstrated to an almost dead certainty, the Yankees are disposed to gamble a bit, and invariably reap the biggest share of the initial profits. Of the seventeen mines under working in the Slocan country this winter but two are run by English companies—at least British subjects—one by Messrs. Mahon, Vancouver, and another by a purely English syndicate.

The Slocan country is being developed more this year than ever in its history. The Washington, the Grand Western, the Alpha, Bluebird, Freddy Lee, Idaho, Queen Bess, Lucky Jim, Dardanelles, Best, Mountain Boomer, Vancouver, Spokane Bay, Noble Supply and several other claims are being run the winter through, development work proceeding on the good properties without intermission.

The Washington has had two tunnels run this season—one of them 200 feet, while the winter contract when complete will bring the total up to 700. In the tunneling some good pay has been struck, a three-foot seam having been encountered with the return of from two to five ounces per ton.

The Slocan Star has stopped work for the winter, but before doing so were down to a depth of 100 feet. The fact of a company such as this going down to such a depth with satisfactory results gave an impetus to all other owners and prospectors. They are now in four feet concentrating ore. White Bros. have every reason to be well pleased with their speculation.

The Freddy Lee, owned chiefly by Jim Wardner, of Fairhaven, is also doing well. The firm has, at present, a pack train of not less than one hundred mules, each carrying 200 pounds, plying twice a week between the mines and Kaslo. From this point the Northern Pacific handles the freight at about $7 per ton. But when the smelter is erected at Pilot bay, the journey will be shorter. The mule pack has been steadily employed for the past couple of months; always with a full load—the product of the mine on the one and that of the farm on the home trip. The ore from this mine ranges all the way from 150 to 500 ounces per ton. Considering that the great Cœur d'Alene mines are more than satisfied with 50 ounces to the ton, it will be seen what an immense fortune there is in the Kaslo mines with from 150 to 500 ounces, as soon as their transport facilities are more favorable. At present it takes some $90 to bring a ton of ore to the smelter, whereas, with the Nelson & Fort Sheppard Railway in operation, the miners might defy the Cœur d'Alene or any other mines in the world.

Messrs. Wardner have spent no less than $6,000 to make a trail to their mines, and very many other operators are clearing the road.

E. H. Tomlinson, treasurer of the Farrel-Hendryx smelter syndicate at Pilot Bay, has bought from E. A. Bielenberg the John W. Mackey, Jim Fair and Flood claims, adjoining the now famous Best mine. Mr. Tomlinson expects to continue work on the Bear Lake claim during winter. The ore of this claim is chloride and brittle silver in quartz, assays from which have yielded $750 and $1,400 per ton.

Yukon County.

Mr. P. G. McDonald, who has spent six years in the country known as Forty-Mile Creek in Alaska, has just arrived down from that section. As to the place and its future prospects, he reports as follows;

"There are two ways," said he, "of reaching Forty-Mile Creek, which is located 700 miles from the headwaters of the Yukon river. One is by way of the Yukon itself. The river is navigable the entire way and four steamers ply it, two of them up as far as Forty-Mile Creek. The other route is by way of Juneau to Chilcat, and thence over the divide into the mines.

"The claims worked so far are entirely placer, as there has not yet been a quartz prospector in the country. The quality of the gold found in the claims ranges from flour to shot, and even larger. The gravel is from four to six feet in depth, and bedrock generally lies from eight to twelve feet down. The gold is quite irregularly distributed, and this fact renders the work rather uncertain. The pay comes in spots and pockets. There is good timber on the banks of the Yukon and especially on the islands in the river, but back a little way from the stream the timber gets smaller.

"The camp is looking better this season than for some years past. The supplies were very good for the season. There were about 200 men on the creek and its tributaries this year. These probably averaged $500 a man for a run of about 60 days. About $2,200 was the largest amount taken out of one claim. Living is very expensive, averaging close upon $600 per year per man. Wages are from $8 to $10 per day, and flour $15 per sack of 100 lbs. There is considerable game in the country, but very uncertain in its movements, rendering it sometimes quite scarce.

"The country ought to be a good one in time as there is gold scattered all through it, but at present it is very little developed, a hard country to get into, an expensive one to live in and the chances of making anything big are nothing to speak of."

Vancouver Island.

The New Vancouver Coal Company is employing at present, including Chinamen on top, about 1,400 men, with a vigilant staff of competent miners continually employed and specially detailed to guard against disaster. In the Esplanade shaft, two electric motors are kept running 16 hours a day to haul coal from the interior. A third motor has been received for No. 2 level in the same mine which will greatly assist in increasing the output.

The following are the foreign coal shipments for the month of November:

New Vancouver Coal Co.	26,665
Wellington	16,638
East Wellington	3,308

The New Vancouver Coal Company's shipments for last month are smaller than during the previous period by 5,243 tons. The Wellington Colliery also shows a decrease of about 200 tons; whilst the foreign output of the East Wellington Colliery shows an increase of nearly 300 tons.

Kamloops District.

Bonds have been signed for the sale of the "Lone Prospector" mine, situated at Mosquito Flats, North Thompson, for the sum of $10,000, to Messrs. H. P. Heacock, of Missoula, Montana, and William Hedge, of Fairhaven, Wn. Messrs. Wood and Tunstall are to be congratulated on the energy displaped in making the first step in opening up the North Thompson mines. Messrs. Heacock aud Hedge are to commence work by April 1st and expect to spend $50,000 on the claim next year in a concentration plant and development work.

The Kamloops Coal Company, Limited, intend to keep 10 or 12 men employed all winter at their mine, on the North Thompson River, preparing the mines for a large force of miners, which will be employed early in the spring, it being the intention of the company to make daily shipments, as soon as navigation opens. The product has proved to be an excellent steam coal, suitable for locomotives and also makes a good strong coke, such as is required for smelting purposes, it being the only coal in the Province which will make coke suitable for this purpose.

An hydraulic claim has been taken up on Tranquille Creek by several residents of Kamloops, a number of whom have been out prospecting for some weeks past. It has long been known that gold existed on the Tranquille Creek, Chinamen having worked the creek and made wages for several years past. The men who made these locations have control of large capital, and will next spring work the mine in the most thorough manner. Some fine samples of coarse gold were washed out while prospecting the ground, which have been sent to friends in the east, who may become interested in the property.

A two foot seam of good coal has been struck on Coal Hill, 2 miles south of Kamloops, by Major Vaughn. An incline shaft on an angle of about 30° is down 100 feet. Prospects are very good for a good bed of coal.

Miscellaneous.

R. G. Tatlow has obtained the consent of the Provincial Government to the extension and consolidation of the leases owned by the several platinum mining companies in British Columbia. He goes to England next week to arrange for the development of these valuable mines.

The Tumbo Island Coal Company is doing steady work on its mines in the Pumpers Pass County.

The Horse Fly company, located about twenty miles from Quesnelle Forks, has done very well on its placer claims and more money has been taken out than during any two years before.

CANADIAN COMPANIES.

The Creighton Gold Mining Company, (Ltd.)—Letters patent were issued to this Company on 16th November, 1892, to carry on mining works and operations for gold, silver, and associated metals and minerals. Capital stock is $1,000,000, in 200,000 shares of $5 each. The names of the applicants are: Alexander Burritt, city registrar; Edward Seybold, merchant; Crawford Ross, merchant; Wm. McGillivray, lumberman; Matthew George Dickieson, accountant; Moses Chamberlain Edey, architect; John Inkerman MacCraeken, barrister-at-law; James Davidson, lumber manufacturer; Walter Silas Odell, brick manufacturer; all of Ottawa, Ont.

The Ontario Standard Oil Company, (Ltd.)—Notice is given in the *Ontario Gazette*, for application for a charter for this company, to sink and work artesian wells for oil, to lay down pipe lines, and to refine and deal in oils and all by-products of petroleum and other oils used

for light or fuel. Operations are to be carried on in the counties of Lambton, Middlesex and Kent, Ontario. Head Office, Toronto, Ont. Capital stock, $250,000, in 5,000 shares of $50 each. Those applying are: Samuel M. Brookfield, ship-owner; Hon. Simon H. Holmes, notary; Donald G. Keith, merchant; Lawrence G. McKain, contractor; all of Halifax, N.S., and Abner Nelson, hotelkeeper, Toronto, Ont.

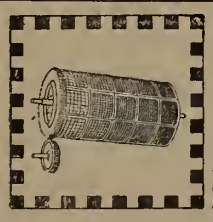
The Toronto and Orillia Stone Quarry Company, (Ltd.) gives notice that application will be made for incorporation under the Ontario Act, to quarry, prepare, and sell stone and lime. The operations are to be carried on at the Township of Rama. Head Office, Orillia, Ont. Capital stock, $10,000, in 100 shares of $100 each. The names of the applicants are: Andrew Tait, lumber merchant, Orillia; Joseph Tait, Toronto; William Britnell, stone dealer, Toronto; Edward Cooper Wainwright, bookkeeper, Orillia, and Cornelius Arthur Masten, barrister-at-law, Toronto.

New Vancouver Coal Mining and Land Company, (Ltd.)—At the semi-annual general meeting of the New Vancouver Coal Mining and Land Company, (Ltd.) held in London on last month, the chairman, Mr. John Galsworthy, expressed regret at the disappointing character of the report. The board had hoped to be able to get through the half-year without any loss, but unfortunately they had made a loss of £4,600. The net output for the half-year had been 177,263 tons, as against 204,890 tons in the previous half-year. That decreased output was one of the elements which accounted for the loss, but a further reason for it was lower prices and increased cost of working. He believed, however, that they had now turned the corner, and, so far as he could judge, they were not losing anything during the current half-year, and the prospects were more encouraging. He was pleased to say that the superintendent had succeeded in obtaining from the men at the Northfield Mine a reduction of 20 cents a ton in labour, and he hoped more would be done in that direction. Since the last meeting the board had allotted £10,600 of the £20,000 debentures of the new authorized issue. After stating that in the face of the loss shown by the accounts, and the present condition of the San Francisco market, the board were unable to recommend the payment of a dividend for the past half-year, the chairman read the following telegram from Mr. Robins (superintendent), dated 26th inst.: "Work resumed on both seams, Protection Island shaft. No change in coal below fault in No. 1 level (No. 1 shaft); two feet mined good. No change in Southfield mines, nor Northfield. Harewood four feet of fine coal. Market more encouraging." He then moved the adoption of the report, which was seconded by Mr. Joseph Fry, and carried unanimously.

Toad Mountain Mining Company, (Ltd.) will apply for incorporation under the British Columbia Companies' Act, 1890, to purchase properties and conduct a general metalliferous and hydraulic mining and smelting business in the ores of iron, gold, silver, copper, clays and other minerals. Capital stock, $1,500,000 in 1,500,000 shares of $1 each Head Office, Nelson, B.C. The trustees of the company are: Aaron H. Kelly, Chas. Van Ness, Frank Fletcher, Andrew Crichton Muir, and Harvey O. Brown, all of Nelson, B.C., and F. B. Morse, E. D. Ide, James N. Glover, R. N. McLean, all of Spokane, Wash.

The Halifax Asbestos Company, (Ltd.) gives notice that application will be made, under the Nova Scotia Companies' Act, for incorporation for the purpose of mining, manufacturing, selling and dealing in asbestos and other minerals. Capital stock, $15,000, in 15,000 shares of $1 each. Head office, Halifax, N. S. The applicants are: Theron R. Gue, capitalist; Charles E. Willis, mining engineer; Arthur E. Curren, merchant, all of Halifax, N. S., and James R. Hayes, merchant, Bay St. George, Newfoundland.

The Montreal Mining Company—Notice is given in the *Canada Gazette* that application will be made, at the next session of the Parliament of Canada, for an Act to wind up and liquidate the affairs of this company, and for the distribution of its assets and dividends. Hall, Cross, Brown and Sharp, solicitors for applicants.



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Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

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Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

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The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 10 cents on every ton sold.

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New York *Sun*, Sept. 12.—"The Crawford Gold extractor, which was recently put into the Richmond Hill at Hillsborough, New Mexico, is giving satisfaction. It has been tested on runs of ores from different mines in the district with uniform good results."

Salt Lake *Times*, Aug. 28.—"Mr. Woodman came in from Deep Creek yesterday, where he has been for a month or six weeks, and he pronounces the Crawford mill a perfect success, saying that since the mill started it has saved 92 per cent. of the assay value of the Gold Hill ores, some of which are very rebellious."

John C. Smith, Supt. of the Ogema Mining and Smelting Co., says: "It gives me great pleasure to add my testimony in favor of the Crawford mill in every way, as to its 'gold saving qualities,' 'practically no loss of mercury,' 'small volume of water required per ton of ore,' great ease of manipulation,' also as to its portability to mines remote from railroads, and 'ease of setting up ready for operation.'"

L. J. Boyd, M.E., Supt. Montagu Mines, after personally supervising a test on arsenical ore says: "The results were simply wonderful. I am personally perfectly satisfied with this system of ore treatment, and should advise its adoption, as the experiments were carried on by my personal superintendence. Similar ore was treated by the Montagu stamp mill showing a difference of 100 per cent. in favor of the Crawford mill."

Fredericksburg, Va., *Free Lance*, Sept. 6.—"L. G. Johnston, of this city, in an interview, said he sent to the M.G.E. Co., N.Y., one ton of very low grade sulphuret ore from the mines of the Powhattan L. & Mining Co, Culpepper Co. He went to New York and personally witnessed the working of the ore. The results of ten different samples of ore, averaging in assay value from $2.13 to $7.35 per ton, showed a saving of 88 per cent. of the value by actual mill run, this without the use of chemicals or fire. These results were so satisfactory that a large sized mill will be placed on the property at once."

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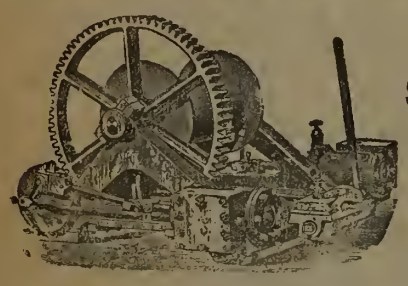

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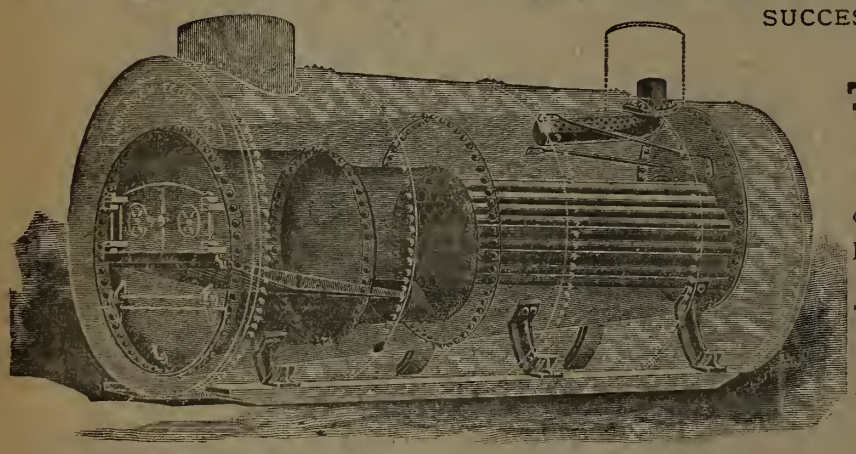

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